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BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

THE INTERNATIONAL MOVEMENT OF FERTILIZERS.

September 1, 1914.

REV. — Introduction (p. 1101). — World's production of fertilizers (p. 1103). — International trade in fertilizers (p. 1109). — Consumption of fertilizers in different countries (p. 1124). — Prices of mineral phosphates, potash salts and nitrogenous fertilizers (p. 1132). — Bibliography (p. 1138).

INTRODUCTION.

This review is the first number of a half-yearly periodical whose publication was decided upon at the last General Assembly held at the Institute (Inst. int. d'agr., 4th Ass. gén., Décis. II, Rapport Pioda-Laur, p. 1101). The general plan of the review was established by the Permanent Committee; it will appear regularly in the official (French) edition on the 1st and September 1st, that is to say at those times of year when purchases are being made by consumers, and will form a continuation to the *production et consommation des engrais chimiques dans le monde*, already published by this Institute.

As regards the products to be considered, the scheme laid down in the above publication has been adhered to and the fertilizers limited to the following categories:

1. *Phosphatic fertilizers*: mineral phosphates, basic slag, superphosphates, guanos, bones.
2. *Potassic fertilizers*: Stassfurt salts, other potassic fertilizers.
3. *Nitrogenous fertilizers*: nitrate of soda, sulphate of ammonia, synthetic fertilizers, organic fertilizers.

In consideration of the similarity of their market conditions, strontium and copper sulphate have been included in the Review as other products useful to agriculture.

The Review comprises five parts: production, imports and exports, consumption, prices, bibliography.

The figures given refer as far as possible to the whole year 1913 and the first half-year of 1914; those referring to 1912 have also been reproduced for comparison. Prices are those of the first half of 1914 and of forward deliveries for the end of 1914 (1). The next number of the review, to appear on March 1, 1915, will contain final figures for 1913, and as far as possible those for 1914, while prices will refer to the second half of 1914 and of forward deliveries for the beginning of 1915.

Production. — Each fertilizer forming a different category is tabulated according to its production in the different countries.

Imports and exports. — The principal products which are classed under separate headings in official returns are each tabulated to show commercial movement in the different countries; an official statement of the international situation is thus obtained.

Consumption. — A few figures obtained by the Institute will be published under this heading; statistical information on this point is difficult to obtain and should form the object of future development.

Prices. — Wholesale market prices from certain important markets are selected for reproduction and where necessary a distinction will be drawn between nominal quotations and actual selling price. This part of the Review will be further developed as time goes on in order that it should prove of the greatest possible practical value.

Prices of mineral phosphates are given both in America and in Europe. Potash salts are quoted at the German official prices and at New York, the latter as representative of the most important independent market.

Official quotations from the principal markets are compared for nitrate of soda, sulphate of ammonia and synthetic manures during the first six months of 1914, the figures referring to prices at the end of each month.

Bibliography. — Discoveries of new beds or the adoption of new manufacturing processes for dealing with chemical products used in agriculture will be notified in this part of the Review, as well as new methods of applying such products or legislative measures in connection with them.

(1) Quotations for forward deliveries have become invalid owing to the present international situation.

WORLD'S PRODUCTION OF FERTILIZERS
AND OF CHEMICAL SUBSTANCES FOR AGRICULTURAL USE.

Phosphatic Fertilizers.

I. — WORLD'S PRODUCTION OF NATURAL PHOSPHATES.

Country	1912	1913	1st half-year 1914
	metric tons (1)	metric tons	metric tons
<i>a) Phosphorites:</i>			
United States of America.....	3 231 636	3 202 636	.....
Algeria.....	2 057 498	2 284 678	.....
Tunisia.....	377 601	438 601	239 690
Morocco.....	330 000	335 000	.....
St. Pierre and Miquelon.....	159 512	152 405	.....
Marshall Islands.....	300 000	.....	.....
Guam.....	203 100	.....	.....
Portugal.....	69 958	64 138	.....
Palau (Palau Islands).....	60 000	90 000	60 000
Tuvalu (Tuamotu Islands).....	40 000	.....	.....
French West Indies.....	20 362	.....	.....
India.....	25 000	25 000	.....
South Australia.....	6 198	.....	.....
French Guiana.....	.....	.....	.....
China.....	.....	.....	.....
Japan.....	7 879	8 000	.....
<i>b) Apatites:</i>			
Sweden.....	.....	.....	.....
Finland.....	.....	.....	.....
Canada.....	164	.....	.....
Total.....	6 888 908	(6 600 458)	.....

The figures for the United States refer to amounts mined; amounts despatched were 3 146 573 m. tons in 1912 and 3 020 905 m. tons in 1913. The figures for Tunis also refer to amounts mined, while amounts despatched were 1 923 007 m. tons in 1912 and 1 984 880 m. tons in 1913. The figures for Algeria on the other hand refer to exports and should be increased by amounts consumed internally for the manufacture of superphosphate, which is in part exported (see Part 2, table III, p. 1111).

(1) Metric ton = 0.9931 long ton.

II. — WORLD'S PRODUCTION OF BASIS SLAG.

Country	1912	1913	1st half-yr. 1914
	metric tons	metric tons	metric tons
Germany.....	2 110 000	(2 200 000)	.....
France.....	679 000	(700 000)	.....
Belgium.....	534 000	(500 000)	.....
United Kingdom.....	400 000	404 000	.....
Luxemburg.....	253 000	(250 000)	.....
Austria-Hungary.....	92 000	(100 000)	.....
Italy.....	20 000	20 000	.....
Russia.....	16 000	32 000	.....
Sweden.....	15 000	(15 000)	.....
Other countries.....	(25 000)	(25 000)	.....
Total...	4 144 000	(4 246 000)	.....

Potassic Fertilizers.

With regard to the Stassfurt potash salts, figures are given which have been supplied by the German Potash Syndicate and it should be noted that these differ slightly from those published later by the German Imperial Office of Statistics (see *Vierteljahrshäfte zur Statistik des Deutschen Reichs*).

III. — PRODUCTION OF POTASH SALTS IN GERMANY.

Nature of salts	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
a) <i>Crude salts:</i>			
halite and kieserite.....	5 281 642.7	5 302 350.5	.....
halite (including hartsalz and schönite) and glauberite.....	5 788 371.6	6 305 160.0	.....
Total.....	11 070 014.3	11 607 510.5	.....
b) <i>Treated salts:</i>			
oxide of potash 80 %	471 434.6	484 254.1	.....
hydrate of potash 90 %	115 728.4	110 783.6	.....
hydrate of potash-magnesia calcined 48 %	55 987.2	58 269.1	.....
ash manure salts 20, 30, 40 %	723 257.4	906 212.4	.....
ash manure salts 38 %	48 059.0	50 393.4	.....
hydrate of potash-magnesia, crystal- lized 40 %	172.5	119.4	.....
glauberite in lumps.....	45 492.4	36 708.2	.....
glauberite, calcined and ground.....	1 070.3	1 165.8	.....
Total.....	1 461 201.8	1 647 906.0	.....

IV. — TOTAL AMOUNTS OF POTASH SALTS SOLD FOR
AGRICULTURAL AND INDUSTRIAL PURPOSES (as K_2O).

Destination	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
a) <i>For agricultural purposes:</i>			
Germany.....	463 383.6	536 102.6	.....
foreign countries.....	440 375.4	467 810.6	.....
Total.....	903 759.0	1 003 913.2	.....
b) <i>For industrial purposes:</i>			
Germany.....	65 181.4	68 180.2	.....
foreign countries.....	40 278.3	38 276.0	.....
Total.....	105 459.7	106 456.2	.....
Grand total.....	1 009 218.7	1 110 369.4	.....

Nitrogenous Fertilizers.

V. — GENERAL MOVEMENT OF CHILEAN NITRATE.

Movement	1912	1913	1st half-yr (up to May) 1914
	metric tons	metric tons	metric tons
Production	2 773 459	2 586 975	1 214
Export.....	2 739 530	2 494 166	1 016
Consignments for consumption	2 556 973	2 530 645	1 765
Visible stocks (Dec. 31)	1 765 867	1 620 056	1 205 (May)

VI. — WORLD'S PRODUCTION OF SULPHATE OF AMMONIA.

Country	1912	1913	1st half-yr 1914
	metric tons	metric tons	metric tons
Germany	492 000	549 000	.....
United Kingdom.....	394 500	425 700	.....
United States	149 700	176 900	.....
France	69 000	75 000	.....
Belgium.....	43 700	48 600	.....
Austria-Hungary	35 500	39 000	.....
Italy	11 100	15 000	2
Spain	12 000	15 000	.....
Netherlands.....	6 000	6 000	.....
Russia.....	4 000	8 000	.....
Japan	7 300	8 000	.....
Australia	3 000	3 000	.....
Denmark	2 400	2 800	.....
Sweden	1 400	1 400	.....
Other countries	(75 000)	(75 000)	.....
Total.....	(1 306 600)	(1 448 400)	.....

The figures for the United Kingdom refer to the total amount of ammonia produced, stated as sulphate; according to the Board of Trade the rate of ammonia actually produced would only be a little over 84.34 per cent. of these figures. The amount of ammonia produced in Italy for the first half-year of 1914 refers only to sulphate formed by the conversion of calcium cyanamide.

VII. — WORLD'S PRODUCTION OF CALCIUM CYANAMIDE.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
U.S.A.....	(25 000)	(25 000)	.....
France.....	5 000	(7 500)	.....
Germany.....	(14 000)	(14 000)	.....
Italy.....	(7 500)	(7 500)	.....
Belgium.....	10 304	14 982	12 000
Spain.....	5 199	(7 500)	.....
Japan.....	13 892	22 111	.....
China.....	6 043	(8 000)	.....
Ireland.....	(7 500)	(7 500)	.....
Total.....	(94 438)	(114 093)	.....

Figures in brackets represent the productive capacity of the factories; figures without brackets represent the actual production.

VIII. — MOVEMENT OF NORWEGIAN NITRATE OF LIME.

	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Production.....	.....	70 000	35 000
Exports.....	51 701	70 171	.....

Other Chemical Products for Agricultural Use.

IX. — WORLD'S PRODUCTION OF CRUDE SULPHUR.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
Sicily	356 531	345 349	159 2
Other Italian regions	10 000	10 000	.....
Other Italian regions	37 497	37 839	.....
Italy..... (total)	404 028	393 188	.....
United States.....	308 328	316 575	.....
Japan	54 256	49 131	.....
Other countries.....	(50 000)	(50 000)	.....
Total...	816 612	808 894	.....

According to information from the "Consorzio solferino siciliano" the production in Sicily is made up of the amounts conveyed to exporting ports together with the internal consumption, which is estimated as 10 000 metric tons.

X. — WORLD'S PRODUCTION OF SULPHATE OF COPPER.

Country	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons
United Kingdom.....	85 500	76 843	61
Italy.....	52 312	29 217	.....
United States	17 908	24 643	.....
France.....	26 000	26 000	.....
Austria-Hungary.....	15 200	15 400	.....
Germany	5 942	5 682	.....
Other countries (Sweden, etc.).....	1 000	1 000	.....
Total...	203 862	178 785	.....

The figures given for the United Kingdom are those of exports, which are approximately equal to the production. For Ireland the following figures have been obtained :

	Imports		Exports
1912.	2 899	metric tons	14.2
1913.	4 780	"	3
			"

INTERNATIONAL TRADE.

The data given below are drawn from the customs returns of imports and exports for each country and represent what is commonly termed the actual trade of imports and exports (see: Inst. Int. d'Agr., Publications Bureau de la Statistique Générale, No. 4, *Notes sur les Statistiques du commerce extérieur dans les différents pays, 1914*). The figures referring to similar or almost similar classes of material in the returns have been collected into tables with various headings, qualifying notes being made where necessary.

The fiscal year in Canada ending in March, the figures for the two years ending in March 1913 and 1914 are given under 1912 and 1913 respectively. The same applies to British India.

Phosphatic Manures.

I. — IMPORTS AND EXPORTS OF NATURAL PHOSPHATES.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
any	902 824	928 798	420 165	7 032	6 885	732
Austria-Hungary	175 831	212 003	128 180	.....	.....	.....
Canada	244 221	244 765	113 668	22 916	18 158	10 988
Denmark	45 710	55 875	.....	.....	.....	.....
Egypt .....	.....	.....	.....	52 115	64 183	.....
United States	176 183	254 463	.....	.....	.....	.....
France .....	.....	.....	.....	1 225 824	1 388 362	.....
Germany	907 845	934 679	472 554	22 062	21 128	7 997
Italy	1 910 198	.....	.....	377 601	438 601	239 690
British India .....	.....	.....	.....	.....	.....	.....
Japan	528 591	547 640	279 544	4 492	11 808	26 466
Malaya .....	.....	162 590	.....	.....	943	.....
Netherlands	12 509	8 406	.....	.....	190	.....
Union of South Africa .....	.....	691	.....	.....	.....	.....
Sweden	466 144	529 776	.....	1 285	4 171	.....
Switzerland	286 984	333 916	.....	.....	.....	.....
Siam .....	.....	.....	.....	1	.....	.....
Spain	60 161	.....	.....	5 708	.....	.....
Thailand	47 421	.....	.....	.....	.....	.....
United Kingdom	81 574	110 450	.....	.....	.....	.....
United States	17 821	18 885	.....	.....	.....	.....

II. — IMPORTS AND EXPORTS OF BASIC SLAG.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric
Germany	372 835	441 069	234 681	663 024	713 878	307
Austria-Hungary....	203 336	212 788	110 153	3 607	2 007	
Belgium	130 439	144 553	76 248	550 847	685 907	335
Denmark	9 948	8 957				
France	59 870	41 010	17 933	248 810	246 271	95
	—	—	663 643	—	—	2 312
Great Britain	50 102	51 951	13 450	159 689	167 742	70
Ireland						
Canada.....fr.	47 899	33 042				
Union of South Afr.c.		5 416				
Italy	118 190	119 257	4 727	14	103	
Japan	245	17				
Norway	40 257	34 492				
Netherlands	339 968			154 483		
Russia	170 340					
Sweden	21 047	19 243				
Switzerland	54 182	55 793				

The first set of figures for France are those given under the heading of "machef" in the returns; when ground, the same material was entered under the heading "engrais chimique" till the end of 1913, so that the figures only referred to a portion of the trade in slag; for the first half 1914 the imports and exports of ground slag are given separately in the second set of figures.

III. — IMPORTS AND EXPORTS OF SUPERPHOSPHATE.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
my...	62 399	53 193	29 225	271 349	282 653	192 145
a-Hungary...	79 531	75 224	43 993	5 354	3 748	1 971
un...	37 802	28 012	31 435	314 713	318 922	171 390
ark...	102 135	110 155				
...	11 459	13 148				
...	161 047	149 602				
e...	89 059	100 822	55 768	169 617	145 236	72 001
a...	28 183	18 164	1 284	3 329	8 006	
Britain...				90 314	64 496	28 534
d...						
alia...		27 138			120 881	
la...	878	966				
of South Africa...		37 207				
l...	254	977		25 705	16 885	
o...		60				
ay...	8 543	4 283				
riand...	295 613			346 186		
a...	188 244					
ed...	9 815			57 807	36 037	

In many countries, such as Italy and certain colonies, where the use of fertilizers is still very limited, superphosphate is included under the general heading of "chemical fertilizers" in the returns and therefore does not appear in the table above.

IV. — IMPORTS AND EXPORTS OF GUANO.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric
Germany.....	28 659	35 299	14 283	844	136	
	18 509	26 620	4 886	6 140	5 691	3
Argentine Republic.....				24 078	28 630	
Belgium.....	15 166	49 541	11 099	31 697	29 446	14
Chile.....	509					
Spain.....	2 486	1 781				
United States.....	19 467	19 411				
France.....	311	1 376		403	317	
Great Britain.....						
Ireland.....	14 341	25 957	14 857			
Australia.....		1 362			317	
Canada.....	1 896	3 289				
British India.....	13	93		18 650	21 750	
New Zealand.....	13 574					
Union of South Africa.....		318				
Italy.....	195	111	12			
Norway.....				10 693	13 063	
Netherlands.....	13 890	22 317		11 046	10 968	
Sweden.....	187			454		
Switzerland.....	112	72				

The first set of figures for Germany refer to natural guano, the second to artificial guano and similar products. The exports from the Argentine consist of meat guano, while those from British India, Norway and the greater part from Sweden are fish guano. South Africa, over and above official imports, received 6 993 and 4 830 metric tons of guano from the coastal islands during 1913 and the first half of 1914 respectively.

V. — IMPORTS AND EXPORTS OF BONES AND BONE MANURES.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Denmark	16 343	24 481	13 731	7 870	6 514	3 219
France	36 842	30 845	11 035	28 925	32 474	19 335
Belgium				30 451	30 716	
Switzerland				1 427	895	
Hungary	13 336	7 080		10 193	9 582	
Italy	41 656	45 509	21 110	16 365	22 748	18 844
Spain				1 730		
Sweden				36		
Germany				29 976		
Poland	120			34		
Czechoslovakia	28			4 794		
Austria				4 310	3 747	
United States	34 703	35 173				
Canada	38 095	36 768	22 444	10 973		10 152
Japan	892	2 627	381	977	499	476
China				1 656	1 774	
Great Britain	41 862	41 336	20 002			
India					4 384	
Malaya	1 204	2 207		9	3 311	
Siam	3 839	3 890				
India	52			111 984	107 100	
Colombia				21		
Union of South Africa	10 677			13		
South Africa		4 276				
Argentina				300		
Chile	4 193	5 630	2 115	3 630	7 028	3 642
Peru	39 302	47 891				
Brazil				863	1 217	
Uruguay	1 230					
Paraguay	78			478		
Venezuela	4 475			283		
Colombia				4 527		
Ecuador				5 755		

Where two sets of figures are given for any country, the first set refer to raw bones and the second to treated bones, such as bone flour, bone ash, lined bones.

Potassic Fertilizers.

VI. — IMPORTS AND EXPORTS OF POTASH SALTS.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	a —	—	—	1 300 459	1 676 156	727.0
	b 43	44	52	85 479	133 358	
	c 46	15	30	286 614	393 320	1
Austria-Hungary ..	a 97 721	110 069	54 330	1 572	1 774	
	b 13	19	6	800	1 474	
	c 5 280	5 216	1 889	855	1 317	
Chile	a 49	—	—	—	—	—
Denmark	a 25 887	24 667	—	—	—	—
	b 694 133	600 168	—	—	—	—
United States ...	a 44 071	40 172	—	—	—	—
	b 218 751	217 191	11 335	620	708	
	c 17 805	11 284	30 006	271	134	
France	a 45 174	46 137	—	—	—	—
	b 19 313	17 781	—	—	—	—
	c 442	414	—	—	—	—
Ireland	a 1 204	1 173	—	—	—	—
	b 19	180	—	—	—	—
	c 4 781	6 957	—	—	—	—
Canada	a —	1 812	—	—	—	—
Union of South Africa	a 276	—	—	—	—	—
Greece	b 13 466	9 839	2 059	2.5	0.7	
	c 8 153	7 154	3 246	0.1	—	
Italy	a 81	—	50	—	—	—
Japan	b —	10	50	—	—	—
	c —	81	—	—	—	—
Mexico	a 21 304	21 084	—	—	—	—
	b 83 131	—	—	—	—	—
	c 5 995	—	—	—	—	—
Norway	a 85 776	80 253	—	—	—	—
	b 15 006	13 241	—	—	—	—
	c 1 572	1 572	—	—	—	—
Russia						
Sweden						
Switzerland						

The sets of figures classified as *a* refer to substances designated as "potash manure salts"; those under *b* to substances designated as "sulfate of potash"; those under *c* to substances designated as "muriate of potash". This classification is not, however, always very exact; for example in Italy kainite and other manure salts are included under *b*. Exports for Germany for 1913 are rather high, as they include a large amount of those for 1912.

The only potassic fertilizer classified separately in the United Kingdom is sulfate of potash (see Part 2, Table VIII, p. 1116) the rest are returned under the heading of unenumerated manures.

VII. — IMPORTS AND EXPORTS OF OTHER POTASH MANURES.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
any.....	597	402	276	14 450	16 058	7 551
.....	86					
.....	3 886					
.....	53	71	291	952	708	412
.....	1 293	3 597	1 400	3 719	1 586	1 559
Britain.....	11 034	12 084	6 273	1 935	1 723	74
.....	840	938				
.....	(barrel-)			550	434	
.....	3			15 076	13 618	
.....	998					
.....	2 576					
.....	461	458	209	3	6	
.....		10				
.....	418	522				
.....				1 784	2 521	
.....				32 844	32 796	
.....				7 000	53 047	
.....	4 312	6 721		7 407	6 243	
.....	352					
.....				34 643	37 655	

The product referred to in this table is nitrate of potash except in the following cases :

1. The second set of figures for France, which refer to be potash.
2. The second set of figures for Canada which refer to wood ashes.
3. " " " " " Norway " " kelp ash.
4. The third " " " " " " " felspar.
5. The fourth " " " " " " " ground felspar.
6. The single " " " " Sweden " " felspar.

Nitrogenous Manures.

VIII. — IMPORTS AND EXPORTS OF NITRATE OF SODA.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	812 898	774 299	589 854	27 431	27 557	23 32
Argentine Republic...	373	649				
Austria-Hungary....	92 838	93 025	62 733	403	313	3
Belgium.....	235 382	304 136	164 598	122 668	13 999	88 12
Chile.....				2 498 529		
Denmark.....	36 402	35 024				
Egypt.....	56 047	56 474				
Spain.....	46 715	35 557				
United States.....	444 134	635 876				
France.....	353 776	322 115	232 813	10 233	5 268	18
Great Britain.....	125 557	143 181	66 822			
Ireland.....						
Australia.....		3 393			516	
Canada.....	39 714	36 406				
Union of South Africa.....		66				
Italy.....	54 654	67 418	58 405	27	50	4
Japan.....	85 271	112 405				
Norway.....	1 130	1 337		184	811	
Netherlands.....	204 169	202 928		129 763	121 096	
Russia.....	50 630					
Servia.....	135					
Sweden.....	35 107	33 892				
Switzerland.....	3 162	3 328		37	29	

The official figures given above do not agree with those published by Nitrate Association, which are based on commercial data and therefore do not represent exactly exports and imports (see Bertrand, A., *Cir. No. 60 de la Asociacion Salitrera*, p. 206).

For many countries no figures can be given as special returns for the same are not made, or are published with too great a delay.

IX. — IMPORTS AND EXPORTS OF SULPHATE OF AMMONIA.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
any.....	23 098	34 627	22 528	57 267	73 868	74 723
in Hungary.....	21	51	28	20 818	23 816	20 210
um.....	20 062	24 199	22 976	17 886	41 382	17 239
ark.....				2 415	2 329	
t.....	651	1 650				
d States.....	54 015	59 670				
r.....	22 892	22 995	7 764	1 976	1 151	827
Britain.....						
d.....				289 512	328 223	167 075
ala.....		792			2 340	
la.....	219	159				
of South Africa.....		362				
.....	21 190	21 669	8 253	4	55	8
.....	93 416	26 938				
.....		63	19			
ey.....				175	138	
lands.....	39 275			31 317		
.....	76	136	52			
m.....	46			41		

This table is incomplete, especially with regard to imports in the Indies. Such data may be found in the export returns of the United Kingdom, Belgium (Antwerp), Netherlands (Rotterdam), and now also those of Germany which has started a considerable export trade to Java, the Dutch Indies, etc. (see *Inst. Int. d'Agr. Production et Consommation des Engrais Chimiques dans le Monde*).

X. — IMPORTS AND EXPORTS OF SYNTHETIC NITROGENOUS FERTILIZER

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	44 612	54 378	31 038	8 134	30 466	22 14
Denmark	412	5 066				
Egypt	728	971				
United States	2 339					
France	3 160	10 010	1 531	789	839	
Algeria	766	1 091	458			
Canada	737	1 167				
Mexico			2.5			
Norway				4 270	7 807	
				51 701	70 171	
				13 892	22 111	
	8					
Sweden	176			0.4		
	0.2			4 058		

The imports of Egypt consist only of calcium cyanamide, those of the United States only of nitrate of lime and those of Canada only of nitrate of ammonia, but the latter are probably not put to agricultural use.

The first, second and third sets of figures for Norway and Sweden refer to nitrate of ammonia, nitrate of lime and calcium cyanamide respectively. Figures for the exports of Norway during the first quarter of 1914 are as follows:

2 771 metric tons of nitrate of ammonia
 19 636 " " " " " lime
 9 838 " " " " " calcium cyanamide.

-EXPORTS AND IMPORTS OF ORGANIC NITROGENOUS FERTILIZERS.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Germany	3 261	2 899	1 373	5 307	6 704	3 941
Uruguay	57 930	64 421	35 636	12 022	15 781	9 866
Argentine Republic				13 858	12 782	
Austria-Hungary	893	560	217	3 647	3 444	1 589
	1 237	1 667	963	777	654	388
	140 307			51 066		
				493 477		
					75	
				80 778	62 977	
	72 573	82 072	33 835	31 365	30 728	15 079
India	19	464		164 380	178 126	
	623 471	373 800				
Japan				14 548	8 929	
Ireland	145	136		652	1 626	
	2 190	2 053		1 354	1 579	
Switzerland				137 559		

The first set of figures for Germany, Austria-Hungary and Switzerland refer exclusively to horns and hoofs for manurial use; the second set refer to other animal residues, blood, etc. The figures for the Argentine Republic and Uruguay represent the total slaughterhouse residues including meat guanos and bones, which are given elsewhere.

The exports and imports for China, Egypt and India consist entirely of cakes with the exception of a small export of other material from India shown in the first figure for 1913. Soya bean exports from China are classified separately in the second set of figures for 1912. It should be noted that oil cakes are largely but by no means exclusively used as manure in India.

Other Fertilizers and Chemical Products used in Agriculture.

XII. — IMPORTS AND EXPORTS OF UNENUMERATED CHEMICAL FERTILIZERS

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Argentine Republic..	381	546	.....	.....	.....	.....
Chile	52	.....	.....	.....	.....	.....
China	49 647	.....	.....	.....	.....	.....
Egypt	61	245	.....	.....	.....	.....
United States.....	.....	.....	.....	75 780	73 911	.....
France.....	147 495	223 217	66 364	306 975	403 305	791
Algeria.....	9 493	10 291	.....	.....	.....	.....
Australia.....	.....	10 784	.....	.....	.....	.....
Canada	279 806	312 060	.....	.....	.....	.....
British India.....	54 864	.....	.....	.....	.....	.....
Italy.....	37 032	71 729	15 372	9 243	19 310	14 08
Mexico .....	.....	80	75	.....	.....	.....
Serbia	18	.....	.....	.....	.....	.....
Switzerland.....	25 926	26 309	.....	7 487	10 994	.....

The nature of the products varies with the different countries. France, up to 1914, they included ground basic slag. In Italy the great part of the superphosphate is included. In the United States the figures refer almost exclusively to compound manures exported more especially to other countries on the American continent (Canada, Mexico, etc.).

II. — IMPORTS AND EXPORTS OF OTHER UNCLASSIFIED MANURES.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
U. S. A.	42 085	43 038	18 326	54 414	56 868	23 039
.....	287	.....	.....	14 721	.....	.....
.....	90 684	91 380	.....	14 143	24 869	.....
Britain.....	170 592	175 643	91 217	135 224	154 876	79 437
.....	.....	.....	.....	.....	12 077	.....
India.....	288	.....	.....	8 471	.....	.....
Canada.....	78 782	.....	.....	112	.....	.....
of South Africa.....	.....	7 788	.....	.....	.....	.....
.....	656	.....	.....	.....	.....	.....
.....	19 640	12 651	10 416	19 977	28 670	1 692
.....	85 914	134 397	.....	36 628	27 391	.....
France.....	1 958	1 172	.....	.....	.....	.....
Netherlands.....	1 579 332	1 635 506	.....	109 497	62 215	.....
.....	15 168	.....	.....	.....	.....	.....

This last class of manures is still more heterogenous. In Great Britain and Spain it includes potash salts, while the Netherlands include all others except guano and nitrate of soda under the one heading in their monthly returns, though further classifications occur in their annual reports. In Italy the figures refer exclusively to organic manures amongst which olive and wine pomace have recently assumed some importance.

XIV. — IMPORTS AND EXPORTS OF SULPHUR.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric
Germany.....	42 284	46 737	29 772	1 746	3 472	2
Argentine Republic..	4 549	3 125	.....	.....	.....	.....
Austria-Hungary.....	41 023	39 442	23 781	1 048	312	.....
Belgium.....	15 647	11 724	4 193	10 498	6 745	4
China.....	1 322	.....	.....	.....	.....	.....
Denmark.....	.....	268	.....	.....	.....	.....
Turkey.....	4 768	.....	.....	57	.....	.....
Egypt.....	643	600	.....	.....	.....	.....
Spain.....	6 565	11 202	.....	4	2	.....
United States.....	27 315	14 870	.....	5 865	9 065	.....
France.....	172 181	186 348	82 842	39 694	23 325	12
Algeria.....	26 105	31 991	30 013	.....	.....	.....
Great Britain.....	22 098	18 505	9 081	1 856	731	.....
Ireland.....	.....	.....	.....	.....	.....	.....
Canada.....	32 983	27 085	.....	.....	.....	.....
British India.....	5 841	6 428	.....	.....	.....	.....
New Zealand.....	2 034	.....	.....	.....	.....	.....
Greece.....	8 714	.....	.....	.....	.....	.....
Italy.....	184	183	74	351 330	376 387	194
Japan.....	.....	.....	.....	49 131	54 256	.....
Norway.....	13 911	14 607	.....	.....	.....	.....
Netherlands.....	35 324	36 937	.....	14 341	10 216	.....
Servia.....	71	.....	.....	.....	.....	.....
Switzerland.....	3 356	3 562	.....	.....	.....	.....
Sweden.....	38 471	38 192	.....	.....	.....	.....

Sulphur under all forms (crude or refined) is included in the above table. It is imported chiefly by the countries in which vine or fruit growing is specially well-developed.

XV. — IMPORTS AND EXPORTS OF SULPHATE OF COPPER.

Country	Imports			Exports		
	1912	1913	1st half-year 1914	1912	1913	1st half-year 1914
	metric tons	metric tons	metric tons	metric tons	metric tons	metric tons
Italy	7 074	3 864	4 448	3 812	4 012	3 533
Chinese Republic ..	1 376	1 288	.....	.....	.....	.....
Hungary	16 132	6 937	6 497	119	172	203
.....	221	.....	.....	.....	.....	.....
Germany .....	.....	249	.....	.....	.....	.....
Italy	1 623	.....	.....	1.5	.....	.....
.....	7 121	6 433	.....	1	2	.....
United States .....	.....	.....	.....	3 097	1 910	.....
France	16 801	21 575	21 734	6 904	5 312	5 377
Canada	4 612	3 609	3 687	.....	.....	.....
Great Britain .....	.....	.....	.....	84 124	76 843	63 261
India .....	.....	.....	.....	.....	.....	.....
China	1 152	605	.....	.....	.....	.....
.....	2 524	.....	.....	.....	.....	.....
Japan	36 568	30 450	21 491	1 387	522	1 504
.....	883	.....	.....	.....	.....	.....
Ireland	2 873	2 103	.....	66	62	.....
Denmark .....	.....	.....	.....	513	250	.....

The international trade in sulphate of copper is becoming important; this product, like sulphur, is chiefly imported by those countries having large areas under fruit and vines.

THE CONSUMPTION OF FERTILIZERS IN THE DIFFERENT COUNTRIES.

I. — MOVEMENT IN DENMARK DURING 1913 OF FERTILIZERS AND OTHER CHEMICAL PRODUCTS FOR AGRICULTURAL USE.

Fertilizers	Imports	Exports	Consumption
	metric tons	metric tons	metric tons
<i>Phosphatic fertilizers.</i>			
Mineral phosphates.....	55 875	.....	55 875
Superphosphate	110 151	683	.....
Basic slag	8 944	.....	8 944
Bone flour.....	282	2	.....
<i>Nitrogenous fertilizers.</i>			
Synthetic products	5 066	.....	5 066
Nitrate of soda.....	34 930	.....	34 930
Sulphate of ammonia.....	524	2 830	.....
<i>Potassic fertilizers.</i>			
Kainite.....	9 400	.....	9 400
Others	16 700	.....	16 700
<i>Other fertilizers.</i>			
Lime, in lumps.....	5 079	2 085	.....
Lime, ground.....	1 411	3 357	.....
Marl.....	9 021	.....	.....
Manures from animal sources.....	85	105	.....
Sulphate of copper.....	249	.....	2
Sulphur.....	268	.....	2

The above data were collected by the Danish Office of the International Institute of Agriculture at Copenhagen.

II. — CONSUMPTION OF FERTILIZERS IN THE UNITED STATES DURING THE YEARS 1911-1913.

State	End of fiscal year	1911	1912	1913
		metric tons	metric tons	metric tons
Ala.	Oct. 1	399 161	410 243	430 668
Ala.	—	317	454	544
Ariz.	Dec. 31	36 287	45 359	47 174
Ariz.	June 30	45 087	45 359	32 659
Calif.	—	2 266	2 722	3 175
Calif.	April 30	40 823	43 545	45 359
Calif.	Dec. 31	22 680	27 215	45 359
Calif.	" "	166 411	170 485	193 891
Calif.	Sept. 30	1 091 091	1 001 409	1 016 676
Calif.	—	907	1 361	1 814
Calif.	April 30	72 575	77 111	81 647
Calif.	Oct. 15	163 147	130 342	175 902
Calif.	April 30	1 814	2 268	3 175
Calif.	Dec. 31	1 361	4 530	6 695
Calif.	" "	58 967	58 967	68 039
Calif.	Aug. 31	82 631	68 542	89 610
Calif.	Dec. 31	127 000	136 078	145 150
Calif.	" "	143 335	145 150	153 314
Calif.	" "	65 317	68 039	113 398
Calif.	" "	40 823	46 266	52 603
Calif.	" "	1 814	2 177	3 175
Calif.	Oct. 1	134 478	108 599	116 165
Calif.	Dec. 31	37 816	34 799	54 431
Calif.	—	544	635	726
Calif.	—	272	454	907
Calif.	—	454	544	726
Calif.	April 30	17 236	19 958	22 680
Calif.	Oct. 31	122 470	127 006	142 120
Calif.	—	726	816	907
Calif.	Dec. 31	362 874	385 554	417 305
Calif.	" 1	645 353	631 133	762 441
Calif.	" 31	454	544	907
Calif.	" "	134 263	137 696	167 829
Calif.	April 30	7 257	9 072	16 329
Calif.	Aug. 31	2 722	3 175	4 082
Calif.	Dec. 31	285 763	289 134	308 443
Calif.	June 30	20 865	18 144	17 088
Calif.	March 31	10 886	13 608	16 329
Calif.	June 30	951 461	803 967	833 101
Calif.	July 1	181	272	635
Calif.	June 1	58 967	70 282	76 258
Calif.	Sept. 1	48 067	40 823	68 492
Calif.	Dec. 31	544	635	907
Calif.	" "	18 144	19 958	22 680
Calif.	" "	326 101	337 571	374 154
Calif.	March 31	1 179	1 270	1 361
Calif.	July 1	28 349	28 803	28 896
Calif.	Dec. 31	2 268	3 175	3 629
Calif.	—	113	136	181
Total		5 783 636	5 575 392	6 169 736
	June 30		9	41
	" "		63 500	60 000

also in which there are no fertilizer laws.

The above figures are furnished by the Agricultural Experiment Station in the various States; in the States where there are no fertilizer laws (marked with an asterisk) the estimates are only approximative.

III. — IMPORTS OF MANURES INTO CEYLON DURING THE FISCAL YEAR 1912-1913 COMPARED WITH THOSE OF 1908.

Manure	1908			1912-13		
	Metric tons	Long tons	Price per long ton	Metric tons	Long tons	Price per long ton
			Ruppes *			Ruppes
Castor cake	7 082	6 971	56	4 257	4 190	58
Groundnut cake	—	—	—	15 877	15 627	87
Rape cake	—	—	—	1 510	1 486	42
Fish manure	74	73	57	21 058	20 726	57
Guzno	10	10	120	3 720	3 661	98
Blood meal	—	—	—	2 653	2 611	171
Bone meal	4 789	4 714	55	6 750	6 644	83
Superphosphate	—	—	—	2 549	2 509	100
Basic slag	—	—	—	6 468	6 366	51
Sulphate of potash ..	55	54	166	5 163	5 082	140
Chloride of potash ..	—	—	—	1 224	1 205	133
Kainit	—	—	—	1 651	1 625	510
Nitrate of potash ...	73	72	296	2 115	2 082	200
Refuse saltp. tre	292	287	200	—	—	—
Sulphate of ammonia	137	135	296	2 466	2 427	150
Nitrate of soda.*	—	—	—	278	274	180
Other manures	459	452	167	4 163	4 097	105
Total	12 972	12 768		81 902	80 612	

* 1 rupee = 15 d.

With a cultivated area of 2 800 000 acres (Statesman's Year-book 1914), the consumption of manure per acre is 54.5 lbs.

IV. — CONSUMPTION OF FERTILIZERS IN AUSTRALIA.

	Metric tons	Long tons
South Wales (1912)	39 541	38 918
Victoria (1912)	95 514	94 010
Queensland (1913)	10 368	10 205
Western Australia (1912)	93 073	91 607
South Australia (1912)	48 324	47 563
Tasmania (1912)	9 420	9 272
Tasmania (1913)	8 890	8 750
Territory (1912)	851	838
Territory (1913)	1	1

The figures were received from the Department of Foreign Affairs, Commonwealth of Australia.

V. — CONSUMPTION OF FERTILIZERS IN JAPAN.

Manure	1911			1912		
	Metric tons	Long tons	Value in yen *	Metric tons	Long tons	Value in yen
Superphosphate	266 992	262 788	7 672 105	424 003	417 326	11 721 277
.....	1 078	1 061	44 639	3 622	3 565	107 078
.....	35 888	35 323	2 174 583	35 726	35 164	2 321 479
Manures	1 089	1 072	64 498	1 331	1 310	72 168
of soda	32 257	31 749	4 575 018	41 673	41 017	5 860 553
of ammoniac	11 383	11 204	1 126 376	7 737	7 615	798 720
of nitrogenous	297	292	30 682	5 199	5 117	516 650
of manures	208 469	205 186	14 308 988	237 880	234 134	16 862 526
Manures .....	.....	.....	1 089 225	.....	.....	2 405 835

* = 25 c/d.

The figures were furnished by the Japanese Ministry of Agriculture and Commerce.

VI. — WORLD'S CONSUMPTION OF POTASSIC FERTILIZERS FOR AGRICULTURAL PURPOSES (1).

Country	Potassic manures as K ₂ O in metric tons	
	1912	1913
Germany.....	463 383.6	536 100
Belgium.....	10 945.2	13 140
Netherlands.....	39 473.7	43 478
France.....	31 690.8	33 124
England.....	12 958.9	12 495
Scotland.....	7 182.9	7 198
Ireland.....	3 272.6	3 395
Luxemburg.....	284.0	401
Austria.....	18 873.4	20 074
Hungary.....	3 736.4	4 096
Switzerland.....	3 500.9	3 304
Italy.....	7 295.9	6 354
Russia.....	23 420.0	22 594
Spain.....	9 009.2	8 592
Portugal.....	1 134.4	1 241
Sweden.....	20 670.0	19 313
Norway.....	3 431.0	3 591
Denmark.....	6 006.0	7 477
Finland.....	1 422.4	1 661
Balkan States.....	371.1	194
EUROPE.....	668 062.4	749 001
British India.....	812.4	1 006
Ceylon.....	3 210.9	2 611
Straits Settlements.....	65.2	71
Java.....	355.2	15
Sumatra.....	413.4	41
Celebes.....	—	—
Indo-China.....	21.8	2
China.....	18.9	6
Japan.....	792.2	1 117
Philippine Islands.....	63.0	7
Turkistan.....	—	—
Asia Minor, Palestine.....	70.9	5
ASIA.....	5 823.9	5 71
Marocco.....	—	—
Algeria.....	1 289.8	1 45
Tunis.....	40.5	3
Egypt.....	84.8	1
Carried forward.....	1 415.1	1 37

(1) Figures supplied by the German Potash Syndicate.

VI. — WORLD'S CONSUMPTION OF POTASSIC FERTILIZERS FOR AGRICULTURAL PURPOSES (continued).

Country	Potassic manures as K ₂ O in metric tons	
	1912	1913
Brought forward.....	1 415.1	1 570.3
of South Africa.....	456.9	1 018.1
Colonies in Africa.....	230.1	285.8
.....	1.3	0.2
Congo.....	10.8	.....
.....	688.6	1 109.3
Islands.....	6.9	12.4
.....	67.9	118.5
us and Reunion.....	185.8	126.1
lies.....	.....	.....
do Po.....	77.6	129.4
ent and Principe Is.....	.....	.....
AFRICA.....	3 141.0	4 370.1
States.....	215 965.7	231 689.6
.....	279.2	1 375.3
.....	108.7	91.3
l America.....	243.4	278.5
Indies.....	1 840.4	2 481.2
.....	2 952.3	3 818.8
.....	1 104.5	1 270.9
ay.....	.....	.....
ay.....	13.2	20.1
one Republic.....	21.1	33.3
.....	210.5	202.7
.....	1 315.8	1 004.3
or.....	.....	0.1
bia.....	17.5	4.3
ria.....	0.1	.....
Guiana.....	3.2	12.8
Guiana.....	.....	0.1
AMERICA.....	224 075.6	242 283.3
AUSTRALIA.....	2 621.1	2 490.4
POLYNESIA.....	35.0	56.5
TOTAL.....	903 759.0	1 003 913.2

VII. — WORLD'S CONSUMPTION OF NITRATE OF SODA. (1).

Country	1912	1913
	metric tons	metric tons
England.....	101 080.6	94 360.1
Scotland.....	36 333.9	34 200.5
Germany.....	911 962.2	833 112.5
France.....	354 517.4	327 191.3
Belgium.....	309 817.0	318 314.6
Netherlands.....	180 924.2	164 301.9
Italy.....	44 545.1	51 639.7
Austria-Hungary.....	7 113.5	7 444.6
Denmark.....	4 825.2	10 748.0
Switzerland.....	5 198.0	—
Spain.....	13 554.0	13 159.7
Egypt.....	23 981.0	25 637.7
United States.....	1 993 852.1	1 880 532.2
Other countries.....	441 047.0	589 186.7
Chile.....	93 376.9	84 020.2
	2 368.5	3 212.1
Total.....	2 530 644.5	2 556 971.8

VIII. — CONSUMPTION OF NITROGEN FOR AGRICULTURAL PURPOSES
VARIOUS COUNTRIES, 1913 (2).

Country	Nitrate of soda		Sulphate of ammonia	
	Amount consumed	Nitrogen in amount consumed	Amount consumed	Nitrogen in amount consumed
	metric tons	metric tons	metric tons	metric tons
Germany.....	497 800	74 679	460 000	94 300
United Kingdom.....	133 000	19 950	97 000	19 885
France.....	355 000	53 250	90 000	18 300
Spain.....	13 800	2 070	57 000	11 685
Italy.....	44 600	6 690	29 500	6 013
Austria-Hungary.....	7 150	1 072.5	16 000	3 260
Belgium.....	308 200	46 230	42 000	8 610
Netherlands.....	183 000	27 450	8 000	1 640
Sweden.....	5 220	783	1 350	271
Denmark.....	4 900	735	700	134
Egypt.....	23 800	3 570	2 000	400
United States.....	485 000	72 750	235 000	48 175
Japan.....	21 700	3 255	115 000	23 575
Dutch Indies (Java).....	15 000	2 250	57 000	11 685

(1) Figures supplied by the Chilean Nitrate Propaganda.

(2) Figures supplied by the Deutsche Ammoniak-Vereinigung.

EXPORTS OF SULPHUR FROM SICILY

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Country of destination	Crude				Refined				Subli- mated				Total				Crude				Refined				Subli- mated				Total
	in leaves		ground		in leaves		ground		Subli- mated		Total		in leaves		ground		in leaves		ground		Subli- mated		Total						
	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons	m. tons					
Italy	24 502	1 346	22 507	37 524	393	81 774	17 007	2 255	14 648	33 094	330	67 343	17 007	17 007	17 007	17 007	14 648	33 094	330	67 343	17 007	17 007	17 007	67 343					
Austria	19 571	128	11 554	4 722	360	36 335	11 701	44	4 377	6 268	61	22 431	11 701	11 701	11 701	11 701	4 377	6 268	61	22 431	11 701	11 701	11 701	22 431					
Belgium	9 047	65	3 170	990	40	13 300	3 195	12	291	617	30	4 193	3 195	3 195	3 195	3 195	291	617	30	4 193	3 195	3 195	3 195	4 193					
Denmark	1 586	14	201	201	90	71 305	12 111	12	3	65	20	52 366	12 111	12 111	12 111	12 111	3	65	20	52 366	12 111	12 111	12 111	52 366					
Germany	7 637	77	2 543	5 558	221	10 636	1 959	890	4 110	4 247	38	15 311	1 959	1 959	1 959	1 959	4 110	4 247	38	15 311	1 959	1 959	1 959	15 311					
United Kingdom	1 425	10	1 692	6 704	66	8 502	12	12	1 063	395	10	7 233	1 692	1 692	1 692	1 692	1 063	395	10	7 233	1 692	1 692	1 692	7 233					
Norway	3 105	10	1 692	6 704	66	8 502	12	12	1 063	395	10	7 233	1 692	1 692	1 692	1 692	1 063	395	10	7 233	1 692	1 692	1 692	7 233					
Netherlands	2 173	26	1 692	6 704	66	8 502	12	12	1 063	395	10	7 233	1 692	1 692	1 692	1 692	1 063	395	10	7 233	1 692	1 692	1 692	7 233					
Russia	22 773	25	1 953	1 910	218	24 802	14 076	307	173	6 500	107	6 496	14 076	14 076	14 076	14 076	173	6 500	107	6 496	14 076	14 076	14 076	14 076					
Rumania	2 700	239	771	3 710	218	24 802	14 076	307	173	6 500	107	6 496	14 076	14 076	14 076	14 076	307	173	6 500	107	6 496	14 076	14 076	14 076					
Spain	1 350	601	54	1 101	11	19 542	785	85	85	25	25	8 867	785	785	785	785	54	1 101	11	19 542	785	785	785	8 867					
Sweden	19 378	3	299	1 597	12	19 542	785	85	85	25	25	8 867	785	785	785	785	299	1 597	12	19 542	785	785	785	8 867					
Turkey in Europe	15	134	862	17	17	19 542	785	85	85	25	25	8 867	785	785	785	785	15	134	862	17	17	17	17	8 867					
United States	2 062	202	722	583	410	3 979	20	20	44	148	13	73	3 979	3 979	3 979	3 979	202	722	583	410	44	148	13	73					
Argentine Republic	931	527	527	527	54	712	712	712	192	712	...	212	527	527	527	527	527	527	527	527	527	527	527	527	527				
Brazil	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chile	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Colombia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Costa Rica	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cuba	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ecuador	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
El Salvador	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Honduras	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mexico	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Nicaragua	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Panama	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Paraguay	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Peru	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Venezuela	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Egypt	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Algeria	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tunisia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Union of South Africa	12 600	65	13	1 030	382	44	13 241	2 060	8	17	303	314	13	13	13	13	101	193	314	303	314	314	314	314					
Turkey in Asia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
British India	980	92	1 446	3 151	67	5 736	786	2	45	3 492	293	2 337	3 151	3 151	3 151	3 151	786	2	45	3 492	293	2 337	2 337	2 337					
Australia	13 549	341	2 157	4 137	395	14 441	1 591	1 591	1 591	1 591	6	4 594	4 137	4 137	4 137	4 137	2 157	4 137	395	14 441	1 591	1 591	1 591	4 594					
Other countries	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	228 530	3 337	63 053	210 034	4 797	415 378	118 953	4 088	33 154	33 248	1 601	430 875	118 953	118 953	118 953	118 953	33 154	33 248	1 601	430 875	118 953	118 953	118 953	430 875					
Mean value	£4 18s 4d	£4 10s 7d	£4 6s 11d	£4 17s 0d	£5 11s 6d	£4 5s 4d	£4 10s 7d	£4 10s 7d	£4 6s 11d	£4 17s 0d	£4 3s 10d	£4 17s 0d	£4 10s 7d	£4 10s 7d	£4 10s 7d	£4 10s 7d	£4 6s 11d	£4 17s 0d	£4 3s 10d	£4 17s 0d	£4 10s 7d	£4 10s 7d	£4 10s 7d	£4 10s 7d	£4 10s 7d				

(1) Figures supplied by the Consorzio solferino siciliano s.

PRICES OF PHOSPHATES, POTASH SALTS AND NITROGENOUS
FERTILIZERS DURING THE FIRST HALF-YEAR, 1914.

Phosphates.

N. B. — European prices are quoted per unit of 22 ½ lbs.
American prices are quoted per long ton.

I. — TUNISIAN PHOSPHATE, 58-63 PER CENT. (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	d	d	d
End of January 1914.....	5	5	5 ¹ / ₈	5 ¹ / ₈
• February 1914.....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
• March 1914.....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
• April 1914.....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
• May 1914.....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
• June 1914.....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈

II. — ALGERIAN PHOSPHATE 63-70 PER CENT (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	d	d	d
End of January 1914.....	5 ¹ / ₄	5 ¹ / ₄	5 ³ / ₈	5 ¹ / ₈
• February 1914.....	5	5	5 ¹ / ₈	5 ¹ / ₈
• March 1914.....	5	5	5 ¹ / ₈	5 ¹ / ₈
• April 1914.....	5 ¹ / ₄	5 ³ / ₈	5 ³ / ₈	5 ¹ / ₈
• May 1914.....	5 ¹ / ₄	5 ³ / ₈	5 ³ / ₈	5 ¹ / ₈
• June 1914.....	5 ¹ / ₄	5 ³ / ₈	5 ³ / ₈	5 ¹ / ₈

— ALGERIAN PHOSPHATE, 58-63 PER CENT (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	d	d	d
January 1914.....	5	5	5 ¹ / ₈	5 ³ / ₄
February ".....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
March ".....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
April ".....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
May ".....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈
June ".....	4 ³ / ₄	4 ³ / ₄	4 ⁷ / ₈	5 ¹ / ₈

— FLORIDA HARD ROCK, 77-80 PER CENT (European quotations nominal, American quotations f. o. b. Florida).

Markets	New York	Mediterranean	United Kingdom	North Sea	Baltic
	\$	d	d	d	d
January 1914.....	5.75-6.25	7 ¹ / ₄	6 ³ / ₄	6 ³ / ₄	7
February ".....	5.75-6.25	7	6 ¹ / ₂	6 ¹ / ₂	6 ³ / ₄
March ".....	5.75-6.25	7	6 ¹ / ₂	6 ¹ / ₂	6 ³ / ₄
April ".....	5.75-6.25	6 ³ / ₄	6 ³ / ₈	6 ¹ / ₂	6 ³ / ₄
May ".....	5.75-6.25	6 ³ / ₄	6 ¹ / ₄	6 ³ / ₈	6 ³ / ₄
June ".....	5.75-6.25	6 ³ / ₄	6 ¹ / ₄	6 ³ / ₈	6 ³ / ₄

V. — FLORIDA LAND PEBBLE, 68-73 PER CENT.
(European quotations nominal, American quotations f. o. b. Florida).

Markets	New York	Mediterranean	United Kingdom	North Sea	Baltic
	\$	d	d	d	d
January 1914.....	3.00-3.25	5 ⁵ / ₈	5 ¹ / ₈	5 ¹ / ₈	5 ³ / ₈
February ".....	3.00-3.25	5 ¹ / ₂	5	5	5 ¹ / ₄
March ".....	3.00-3.25	5 ¹ / ₂	5	5	5 ¹ / ₄
April ".....	3.00-3.25	5 ¹ / ₂	5	5	5 ¹ / ₄
May ".....	3.00-3.25	5 ¹ / ₂	5	5	5 ¹ / ₄
June ".....	3.00-3.25	5 ¹ / ₂	5	5	5 ¹ / ₄

VI. — SOUTH CAROLINA PHOSPHATE, 55-60 PER CENT.
(European quotations nominal, American quotations f. o. b. Mt. Pleasant)

Markets	New York	Medi- terranean	United Kingdom	North Sea	Baltic
	\$	d	d	d	d
End of January 1914...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ³ / ₄
» February » ...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ³ / ₄
» March » ...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ³ / ₄
» April » ...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ³ / ₄
» May » ...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ³ / ₄
» June » ...	3.50-3.75	5	4 ³ / ₄	4 ³ / ₄	4 ³ / ₄

VII. — TENNESSEE PHOSPHATE, 78-80 PER CENT.
(European quotations nominal, American quotations f. o. b. Mt. Pleasant)

Market	New York	Medi- terranean	United Kingdom	North Sea	Baltic
	\$	d	d	d	d
End of January 1914 ..	5.00-5.50	7	6 ¹ / ₂	6 ¹ / ₂	6 ¹ / ₂
» February » ..	5.00-5.50	6 ³ / ₄	6 ¹ / ₄	6 ¹ / ₄	6 ¹ / ₄
» March » ..	5.00-5.50	6 ³ / ₄	6 ¹ / ₄	6 ¹ / ₄	6 ¹ / ₄
» April » ..	5.00-5.50	6 ³ / ₄	6 ¹ / ₄	6 ¹ / ₄	6 ¹ / ₄
» May » ..	5.00-5.50	6 ³ / ₄	6 ¹ / ₄	6 ¹ / ₄	6 ¹ / ₄
» June » ..	5.00-5.50	6 ³ / ₄	6 ¹ / ₄	6 ¹ / ₄	6 ¹ / ₄

VIII. — CHRISTMAS ISLAND PHOSPHATE (nominal quotation)

Market	Medi- terranean	United Kingdom	North Sea
	d	d	d
End of January 1914.....	8 ¹ / ₂	8	8 ¹ / ₂
» February »	8	7 ³ / ₄	8
» March »	8	7 ³ / ₄	8
» April »	8 ¹ / ₄	8	8
» May »	8 ¹ / ₄	8	8
» June »	8 ¹ / ₄	8	8

IX. — OCEAN ISLAND PHOSPHATE (nominal quotations).

Markets	Mediterranean	United Kingdom	North Sea	Baltic
	d	d	d	d
d of January 1914	8 ¹ / ₄	8	8 ¹ / ₄	8 ¹ / ₄
" February "	8	7 ³ / ₄	8	8
" March "	8	7 ³ / ₄	8	8
" April "	8 ¹ / ₄	8	8	8
" May "	8 ¹ / ₄	8	8	8
" June "	8 ¹ / ₄	8	8	8

Potash Salts.

X. — MAXIMUM PRICES FOR POTASH SALTS FIXED BY GERMAN LAW.

	Potash content	Per unit of 22.4 lbs	
	per cent.	s	d
trallite	9-12 (ground)	10	1 ¹ / ₄
ule salts (kainite, hartsalz, sylvinite)	12-15 (ground)	1	0
stish manure salts	20-22	1	4 ¹ / ₄
" " "	30-32	1	5 ¹ / ₂
" " "	40-42	1	6 ¹ / ₂
chloride of potash	50-60	2	8 ¹ / ₄
" " "	above 60	2	10 ⁵ / ₈
ulphate " "	above 42	3	5 ⁷ / ₈
" " " magnesia		3	1

PRICES OF POTASH SALTS

XI. — CURRENT PRICE OF POTASH SALTS IN GERMANY, CALCULATED FROM TABLE X.

Nature of salts	Potash content	Price per ton		
	per cent.	£	s	d
Carnallite.....	9	7	7	
".....	10	8	6	
".....	11	9	4	
Kainite (hartsalz or sylvinite).....	12	12	0	
" " ".....	13	13	0	
" " ".....	14	14	0	
" " ".....	15	15	0	
Potash manure salts.....	20	1	8	0
" " ".....	21	1	9	0
" " ".....	22	1	10	10
" " ".....	30	2	3	3
" " ".....	31	2	4	5
" " ".....	32	2	0	2
" " ".....	40	3	1	8
" " ".....	41	3	3	2
" " ".....	42	3	5	0
Kainite, ground fine, special type for the destruction of weeds.....		5	0	
		(extra)		

The above prices (Tables X and XI) refer to fertilizers consumed in Germany. For other countries the prices are fixed each year at the beginning of the season and are reckoned as at Stassfurt, always at higher prices than the same fertilizers intended for home use.

XII. — PRICES OF POTASH SALTS AT NEW YORK, JANUARY-JUNE, 1915

Nature of salts	Potash content	Price per long ton		
	per cent.	\$	£	s
Kainite.....	12.4	8.36	1	14 4
Hartsalz.....	16	10.87	2	4 8
Potash manure salts.....	20	13.58	2	15 0
Double " ".....	48-53	25.04	5	2 10
Sulphate of potash.....	90-95	47.57	9	15 4
Chloride " ".....	80-85	41.65	8	11 6
" " ".....	95	40.75	8	7 4
" " ".....	98	39.07	8	0 0

The New York market prices are used by the experiment stations value commercial fertilizers in the States in which the fertilizer trade controlled.

Nitrogenous Fertilizers.

III. --- PRICES OF NITRATE OF SODA PER LONG TON ON THE SPOT.

Markets *	Antwerp	Dunkirk	Genoa	Hamburg	Liverpool	New York	Rotterdam
	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d
1914.....	9 18 7	9 19 5	10 11 6	9 19 5	10 8 6	10 4 10	10 1 11
1915.....	10 6 3	10 9 6	10 11 6	10 9 5	10 10 0	10 4 10	10 10 10
1916.....	10 0 3	10 2 3	10 11 6	10 4 11	10 11 10	10 4 19	10 5 11
1917.....	9 8 6	9 10 2	10 4 5	9 9 0	10 6 3	10 4 10	9 12 0
1918.....	9 11 4	9 12 7	10 2 2	9 14 0	9 18 6	10 4 4	9 13 0
1919.....	9 13 4	9 18 7	10 2 2	9 10 0	9 17 6	9 17 11	9 15 0

* All quotations are for the end of the month except in the case of Liverpool which, gives averages for the month.

V. --- PRICES OF SULPHATE OF AMMONIA PER LONG TON ON THE SPOT.

Markets	Antwerp Comptoir end of the month	Genoa (end of the month)	Hull (middle of the month)	New York (end of the month)	Paris (end of the month)
	£ s d	£ s d	£ s d	£ s d	£ s d
1914.....	12 19 10	13 7 11-13 10 0	12 7 6	13 2 4	12 17 10
1915.....	13 1 10	13 5 11-13 7 12	12 9 8	13 2 4	12 13 9
1916.....	13 1 10	13 3 10-13 7 11	12 7 6	13 2 4	12 13 9
1917.....	11 17 8	12 17 10-13 1 10	12 4 2	13 2 4	12 5 9
1918.....	10 17 6	12 9 9-12 11 10	11 6 0	12 8 7	11 13 8
1919.....	11 1 7	12 7 9-12 9 9	10 9 4	11 7 10	11 11 8

--- WHOLESALE PRICE OF NITROGEN PER UNIT OF 22.4 LBS AT ANTWERP.

Nitrogen contained in :	Nitrate of soda	Sulphate of ammonia	Calcium cyanamide	Nitrate of lime
	£ s d	£ s d	£ s d	£ s d
January 1914.....	12 10	12 10	12 2	14 8
February ".....	13 3	13 0	12 2	14 8
March ".....	13 0	13 0	12 2
April ".....	12 1	11 9	12 2
May ".....	12 4	10 9
June ".....	12 5	10 11

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FIRST PART.
ORIGINAL ARTICLES

Agricultural Education in Hungary

by
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Agricultural instruction in Hungary is given in the following special establishments :

Royal Veterinary College at Budapest.
Royal Agricultural College.
Agricultural Training Colleges for primary school teachers.
Schools of Practical Agriculture.
Royal Dairy School.
School for Dairymen.
Special schools for special branches.

There are further 28 lecturers from the Training Colleges acting as organisers and advisors.

Royal Veterinary College at Budapest. — This institute: *a)* provides course of instruction and training in veterinary science; *b)* grants degrees to veterinary surgeons; *c)* furthers the interests of veterinary science by observations and experiments; *d)* provides expert opinion for questions of veterinary science and hygiene; and *e)* obtains information for government purposes or for the Law Courts on veterinary questions. The course lasts four years (eight terms) and students to be admitted must have taken the school leaving examination of the middle schools; students kept in a foreign veterinary school of similar standard are recognised. The course leads to graduation with a doctor's degree. The staff consists of a director, twenty lecturers and 25 assistants and clerks. During the session 1912-1913, 190 students were in attendance.

Royal Agricultural Colleges. — Students having been through the middle schools and requiring a higher agricultural education, both practical and theoretical, go to one of the five Royal Colleges at Debreczen, Győr, Keszthely, Kolossvár and Magyaróvár respectively. These institu-

tions take both full-time students and those who only wish to follow certain lectures. The course lasts three years (6 terms) and during the first year the instruction chiefly takes the form of practical work. The following subjects are taught at the Colleges: natural history, physics, plant production, rural economics, social economics, and practical agriculture including special branches.

Each College has a farm of 640 to 1100 acres attached to it for instruction in the actual practical work. Besides teaching, the staff carry on a certain amount of experimental work and advises on agricultural operations, for which purpose an agricultural consulting committee has been organised in each institution. During the session 1912-1913, 452 full-time and 9 part-time students were in attendance. The capital involved in these institutions amounts to £267 808, while the returns from the farms in 1913 were £3 144 (1).

Training Colleges for Elementary School Teachers. — Two training colleges have been established, one at Kecskemét for men and the other at Komárom for women (2) in connection with the Schools of Practical Agriculture in those places. Students who have taken the college diploma may become teachers in the rural complementary schools and some of the women students take up posts in the schools of domestic economy. The course lasts two years and only those candidates are admitted who already have their teacher's certificate and are under certain age limits, viz. twenty-two and twenty-four years old for men and women respectively. Forty students can be taken at Kecskemét and thirty at Komárom; the teaching staff amounts to seven and five lecturers respectively. Instruction is both practical and theoretical, the performance of a certain amount of practical work being compulsory. Women students are given general instruction in domestic economy as well as in agricultural subjects. Excursions are arranged to visit model farms in districts where poultry farming and market gardening are important industries, in order to provide the students with good object lessons in those branches. The students are frequently called upon to give popular lectures and demonstrations as part of their training.

Schools of Practical Agriculture. — These are the most elementary agricultural schools in Hungary and provide technical instruction to the sons of small farmers and under-managers on large estates. They are under Government administration and their organisation varies with the requirements of the district in which they are situated: for instance those at Ada, Békéscsaba, Hodmezővásárhely, Jászberény, Karczag, Kecskemét and Nagykovács have a six-months course for farmers and small landowners in the general management of holdings, while the schools at Kiskunfélegyháza, Lugos, Pápa, Rimaszombat, Somogyzentimre, Algyógy, Breznóbuda, Csák, Csikszék, Komárom, Nagyszentmiklós and Szilágysomlyó have

(1) See also No. 453, B. May 1913.

(2) See No. 402, B. May 1914.

two-year course and give more advanced instruction adapted to the needs of farmers, under-managers and inspectors.

In all these schools the instruction is chiefly of a practical nature and much stress is laid on the satisfactory performance of the various kinds of manual work; on the theoretical side, only the most fundamental and indispensable facts are treated, the object being to keep the whole scheme of instruction at a popular level. Schools which are destined solely for the training of under-managers take pupils of twenty-two years of age, previously after they have finished their military training; other schools take pupils of seventeen years old and upwards. At Algyógy there is accommodation for sixty internal students, who do all the practical work both in the fields and the garden.

Short elementary courses, lasting two months, are organised at these schools during the winter for adults who cannot leave their farms for a longer period of time. Besides these, short summer courses lasting four weeks are held for elementary school teachers who wish to qualify as complementary school teachers, and popular lectures are given to the farmers of the district on the use of farm implements and the cultivation of special crops. During the winter the regular students receive instruction in the domestic sciences. All teaching is done in the simplest language and illustrated by practical experiment and demonstration; for this reason, special importance is laid on the organisation and equipment of the model farms, which cover altogether an area of 11 700 acres, part of which is State land while the rest is either let or given rent-free by landowners. The cost on these farms for 1913 amounted to £4873.

The staff of each school consists of a director, an agricultural demonstrator, a gardener and a practical assistant.

Besides these State schools there is an Agricultural School belonging to the town of Szabadka staffed by Government teachers. Private Agricultural Schools receiving State grants are also to be found at Csákvár, Pétercze, Földvár and Medgyes; they are organised on similar lines to the State schools.

Royal Dairy School at Sárvár. — This institution provides suitable training for managers or skilled workmen of milk and cheese factories. Though students receive both practical and theoretical instruction they are divided into two classes according as they are preparing to become managers or skilled workmen. The former class have to be over twenty years of age and to have already been through a course at a school of practical agriculture; the latter class are admitted at seventeen and only require to be able to read and write; during the session 1912-1913 attendances numbered 4 students of the former class and 17 of the latter. The course lasts one year.

Schools for Dairymen. — There are two of these, at Kiszér and Csákvár. The course is essentially practical and lasts one year.

The State Lecturers who teach agriculture in the agricultural districts also act as advisors and organisers in the various districts, and publish agricultural articles for the local papers, give lectures and

supervise model farms. Besides these twenty-eight lecturers there are two lecturers in secondary boys' schools to help with the general organic and advisory work and four specialists to advise more particularly on cultivation of potatoes, hops, hemp and flax, and on the improvement of pastures.

A *School of Domestic Economy* has been created at Putnok for daughters of farmers, while seven travelling schools each under the control of two teachers give courses lasting six weeks in other parts of the country. They receive State grants amounting to £1666 annually.

During the winter popular agricultural lectures are given, to which the State makes an annual grant of £4170.

Special schools also exist for the various branches of agriculture such as poultry keeping, bee keeping, viticulture, horticulture, forestry, etc.

In conclusion the following figures summarise the annual expenditure by the Hungarian Government on agricultural education, which is almost entirely directly dependent on the State.

	Ordinary expenditure £	Extraordinary expenditure £
Royal Veterinary College	21 846	4 417
Agricultural Colleges	48 929	9 792
Lower agricultural education, including advisory and organising work	84 047	22 000
Totals . . .	154 822	36 209

Reclamation in the Province of Ferrara

by

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The agricultural awakening of the Province of Ferrara has been closely connected with the carrying out of the projects of reclamation work was begun under the rule of the Este family, but reached its development in the second half of last century, when, with the help of modern engineering methods, human activity was able to attack and conquer the problems entailed in the definite and permanent reclamation of the marshes and lagoons.

The traces of the work carried out by the organizations formed to deal with these problems as far as the then existing means would permit will never be effaced; the division of the Ferrara territory into four districts still exists, and it may truly be said that the colossal work of technical drainage performed on the second and third of these forms one of the most imposing monuments to the civilization of the third Italy.

Out of the 655 000 acres forming the territory of the Province, one reckons 155 000 as still occupied by bracks used for fishing (115 000) or by rivers, canals, buildings, etc.; the remaining half a million acres present the raw material of agricultural and forest production. The named may be left out of consideration, as the woods occupy hardly such as 6 500 acres, mostly in the territory of Mesola, — a poor remnant, though, with the classical pinetum of Ravenna, serves to recall the vast tracts of holm-oak and pine which in ancient times clothed the further shores of the lagoons of Venice and the Romagna.

The survey of 1835 divided this area of 500 000 acres into 204 020 acres of field crops, 172 080 acres of natural meadows and pastures, and 953 acres of reed-beds; the data for the agricultural survey of 1906 give 399 608 acres of crops and 80 015 acres of meadow, leaving some 100 000 acres for woods and vineyards.

These figures give a clear idea of the scope of the reclamation work: the arable area has been *doubled* as a result of draining the marshes and meadows and pastures — a euphemistic way of referring to swamps, dry or quite unproductive; these have been turned into highly fertile lands on which wheat, hemp, beets and leys extend yearly and give such enormous crops that this land must be considered as among the most productive in the whole of Italy.

At the present time the agricultural land of Ferrara consists of a complete patchwork of newly-reclaimed plots with the ancient holdings and old lands under cultivation for centuries. Although the contemporary record of this story contains many unfortunate episodes, so that with the names of the successful men must be mentioned others who have spent labour and means in vain, yet the impetus to further conquests shows no diminution. There are already 215 000 acres from which the drainage water is drawn off by 18 pumping-stations, and projects are on foot for further areas, each of some 20 000 acres: one belonging to the northern plains ("valli") of Comacchio, and the other in the salt levels of Argenta and Porto Maggiore, which will form the so-called Mantello plains ("boni del Mantello").

In contrast with this land drained mechanically by pumps — that is the typical Ferrarese type of undertaking — should be considered the case in the commune of Bondeno which has a natural outlet, the water running off by means of the great canal of Burana or Volano, which passes near the river Panaro by means of the famous "Botte Napoleonica". A vast zone of reclaimed land consists of 26 690 acres in the Province of Ferrara, 54 750 acres in the Province of Modena and 47 060 acres in the Province of Mantua. With the drainage water from this great basin and the possibility of receiving water from the main stream of the Po through Filastresli sluices, the old Volano course of the Po has again become a river rather than a canal, and indeed for a considerable distance has a natural fall; it has also become the principal waterway of the Ferrara district, as well as a source of water for agricultural purposes.

The particulars of these reclaimed lands have been given in detail in various publications, to which we would refer readers who wish to study the question more in detail. In this short account it seems best to call our attention to certain features of a general character.

From the purely technical point of view reference should first be made to the great difference in the problems presented according as the land has been reclaimed from freshwater or from saline marshes ("valli d'ole" or "valli salse").

The low-lying parts of the *freshwater marshes*, prior to drainage, were occupied by a more or less vigorous growth of reeds or other marsh plants. The succession of generations of such rhizomatous plants for centuries has given rise to strata of peat ("cuora"), in some places reaching a sufficient depth to allow of utilization for burning or as raw material for certain industries. But even these marshes rest on a distinctly saline subsoil as can be seen at once from the nature of the water at some depth. Except for the markedly peaty areas, which require quite special treatment, we may say that these soils present no special obstacles to opening up for cultivation. With systematic treatment they may in a short time put under highly paying crops. The fact that sufficient care has not always been taken in dividing up these lands is due to difficulties of a different character (to which we shall refer shortly) and not to the physical character of the soil.

The behaviour of the land obtained by reclaiming *salt areas*, or brackish, is totally different, and as the new schemes refer to the inuring of land covered by salt water it seems advisable to go more into detail on this point. Anyone familiar with the "Gallare" — typical of inland of this kind — or similar farms, such as what was once the Tassabracchi (reclaimed by Cav. M. Marini), knows that considerable areas may remain refractory to the usual methods of cultivation for several decades after the completion of the engineering works freeing them from water. Soils impregnated with saline matter, such as those inured from a lagoon, require special treatment to deal with the sterility resulting from the accumulation and continual change of level of these salts in the arable layer. We may here mention one or two fundamental points of such treatment not always remembered by the promoters of the reclamation of bracks: owing to the position of these soils, their physical and chemical composition and their structure, and owing to the enormous quantity of salt contained in the mass, the possibility of profitable cultivation — when the engineering work is finished — is not only dependent on a period of absolute unproductivity, much longer than is generally admitted, but even later is subject to variations which cannot be foreseen and which are due to the special behaviour of the saline matter.

We have already given prominence to these considerations, though fully aware that they cannot outbalance the reasons of a social nature and especially of convenience which have created an opinion decidedly favourable to the carrying out of the reclamation of the stretches of land in question. It would be well that the example of the practical results

ished by the reclamations already accomplished should not be taken as the only criterion for the opening up and improvement of the neighbouring land, which is not always in a suitable condition for reclamation with a view to agricultural use. The planning, the execution and the completion of the past, present and future reclamations should not be effected entirely to the detriment of the "water farming" (*vallicoltura*); an investigation should be undertaken with a view to establishing once for all the productive capacity of this land under water and the best means of encouraging a profitable and intensive "farming" of it; such "farming" requires far sinking of capital and at the same time lends itself to the natural tendencies of the local inhabitants concerned, so that it might well hold its own in comparison with the arable land to be inned from these inlets of the lagoon.

The fundamental work of reclamation for both freshwater and salt water consists in drying, that is in the mechanical drawing-off of the ground water. There is not the slightest doubt as to the perfection with which this is now carried out by the engineers, who are thoroughly versed in the drawing up of the necessary plant and in the maintenance of the scheme of drainage; in all the operations so far carried out the removal of the water has been obtained in the most perfect and simple manner possible; though the radical evacuation of the water is the primary necessity for these tracts of land, at such a very low level, it is only one side of the complex problem involved in opening them up for agricultural use.

This drying is naturally only relative, allowing a certain depth of free water above the water-table. For this reason the individual characteristics of the different soils, especially as regards water-holding capacity, should be taken into account; evidently sandy and clay lands cannot have the same treatment. The possibility of cultivating these reclaimed lands very largely depends in particular on the reserves of water which the crops have at their disposal, and obviously an excessive drying may be as injurious as a condition of stagnation leading to swamp formation.

The working of the pumping engines is so regulated as to avoid any error in this direction. In some of the very large sections covering something like 100 000 acres there are considerable differences in level; in such cases it is now the rule to keep the so-called high-level water separate from the low-level water, the two being dealt with by different pumping stations. As an example of this may be mentioned the system adopted by the Association for the "Grande Bonifica"; for the completion of this area, carried out between 1905 and 1910, they rearranged the old canal at Codigoro to dispose of the high-level water (from an area of 39 929 acres), while the low-level water (from 89 875 acres) runs off by means of a pumping station put up close to the old one.

Although the drying is carried out in accordance with the needs of the crops, these are subject to the same risks as those on the neighbouring arable lands as regards water supply. Indeed seasons in which the yield of these artificially dried soils is seriously reduced by drought are by no means rare.

In fact drought makes itself felt more severely on these soils, as water is liable to take up mineral matter from the subsoil, constantly impregnated with salt, and may thus become too saline for the ordinary crop. We have elsewhere had occasion to refer to the difficulties attendant on the excess of saline matter in the water taken up by the arable layer, which may provoke a special condition of "physiological drought"; the same point has been referred to by Tacke in his masterly advice on the water economy of moor and fen soils: "The drawing-off of the water must be done with great care, as organic soils retain large quantities of water with such tenacity that the roots of the plants growing in them cannot make use of it; in such soils plants may suffer from lack of water in presence of considerable quantities of it....; once the stagnant water has been drawn off with and the land brought under cultivation, only small amounts of water should be drained off".

Pure sandy soils require similar treatment, as their productivity depends entirely on the presence of the water-table near enough to the surface to be within reach of the roots. The vineyards of Comacchio and parts of the cultivated land of the Mesola are in a flourishing condition solely because the water conditions have not been disturbed; they form a marked contrast to certain old sandhills wedged in between low-lying reclaimed zones and consequently subject to excessive drainage: the careful running off of the rainwater and the lowering of the water-level in the soil has led inevitably to absolute sterility in the higher sandhill tracts. In the modern work of completion of the Grande Bonifica it was recognized that this area would have to be isolated from the remainder and submitted to special treatment suitable for sandy land.

So far no plans have been made for correcting any possible deficiencies in the drainage schemes by means of irrigation. It is certainly exasperating in some years to have to watch the crops daily drying owing to continued drought, while up above the Grande Bonifica rises the great bank holding in the water of the Po on its way to the sea; the water is, however, coming to be used for hygienic and agricultural purposes as the need has become more acute with the yearly increase of the permanent population of the reclaimed lands.

It should be recognized that while the removal of the water — the main scope of the *engineering reclamation* — presents great difficulties the difficulties encountered in the *agricultural reclamation* — that is, in bringing up the land for cultivation and colonization — are equally serious, if not more so. The water from the ditches and main drains, as well as ordinary well water, is absolutely unfit for watering cattle or for house and agricultural purposes; it is charged with saline and organic matter and becomes putrid in summer. Petitions for a supply of drinking water used frequently to be made by the people of the reclaimed areas; it was owing to the initiative of the Commune of Iolanda di Savoia that legislation in vigour was altered, so that by the law of June 25 and 13, 1911, communes in reclamation areas were added to the list of those allowed special facilities for the provision of drinking water. "If

immune, planned and founded contemporaneously with the carrying of the reclamation scheme, cannot boast a past, it may well be proud of its present work"; so said Comm. A. Marangoni, who has been intimately connected with the Grande Bonifica of Ferrara, on the 15th of June, 1913, opening the communal aqueduct, by means of which Iclanda di Savoia is no longer fetid and stagnant water spreading fever and death, but clean and healthy water shooting up to many feet above the ground and giving healthy and vigorous life to these redeemed lands."

In the vast area of the Grande Bonifica (133 000 acres) provision has been made for obtaining water from the Po by means of four syphons, planned and constructed under the direction of Ing. Pasini. All the farms in the area feel the benefits of this work in completion of the reclamation, they can provide water for the watering of live stock, for household use and for retting hemp. A logical finishing touch would have been the carrying out of Ing. O. Balduzzi's scheme for a Po valley aqueduct, to provide drinking water to the 103 200 inhabitants of 11 communes lacking it. As this remained in the condition of a project, the Ferrarese Reclamation Society — whose land makes up the greater part of the Comune Iclanda di Savoia — with its usual enterprise, took up the construction of the communal aqueduct under the provisions of the law mentioned; Po water is filtered and purified on the Puech-Chatal system and brought to the area by a steel conduit 18 miles long; finally it is distributed to the chief farms and groups of houses in the territory of the commune at a rate of 14 000 cu. ft. per day.

The Volano Po, or Burana, which runs from west to east through the province of Ferrara, has also been laid under contribution for water for agricultural purposes. Its value has been increased since the construction of the Pilastresi sluices has allowed water from the main Po to be run into it, but unfortunately the Burana is, and will continue to be, chiefly a drainage canal into which are run the waters from the 3rd, 4th, and 6th sections of the Burana innings: it also receives the water from the hemp-pressing and in particular the refuse water from the sugar factories along its course. For these reasons water from it has a very limited use, and one of the associations most concerned is now making plans for obtaining water direct from the Po for the needs of its vast territory.

While the provision of water for agricultural purposes in this drainage section is difficult and costly, the provision of drinking water is equally so and sometimes not economically possible: we do not here refer to shallow wells, as with rare exceptions the water they give is scanty and bad. For the best results have been obtained by deep tubular wells, of which there are a certain number here and there in the Ferrarese territory. Their depth varies from 80 to 600 ft.; some only lasted for a very short time, while the use of the water from some others was prohibited for preposterous hygienic reasons about the quality. Special mention should be made of the well bored at the Bastioni farm on the Val Gallare property; this is nearly 600 ft. deep and for over thirty years has given a constant supply of about 1 ½ gallon per second. Last year this source was covered

in, and after filtration it is now distributed through 12 miles of steel tubing to 40 fountains at the numerous farms round.

Yet another vital problem of the reclaimed zones remains to be mentioned, namely the question of means of communication: there are still large areas inaccessible for several months in the year owing to lack of roads. The laying of good roads to connect the reclaimed lands with the nearest centres requires a great outlay. Happily the most economic means of transport of agricultural produce, namely by water, can to some extent be substituted for roads, which in these one-time bracks are yet to come. The chief canals have indeed been arranged so as to be navigable, but access to the wharves or landing-stages must be provided and the farms must be joined up one to another and to the nearest centres. There is no need to go deeply into the question, as the above will suffice to call attention to one of the causes which has contributed and still contributes to retard colonization of the reclaimed areas.

These considerations indicate that it would be very instructive to make an investigation into the real cost of reclaimed land, especially so as to be able to make proper comparisons as to the utility of continuing the draining at the expense of the lagoon. There is a fundamental difference between schemes which have in view the reclamation of land at present more or less completely and constantly submerged under salt water, and such schemes as the great Rhine reclamation, now being carried out, in which it is a question of laying out permanent drainage for vast stretches of land whose productive power is paralyzed by the lack of a proper outlet for their waters. Probably, however, the calculation of the true total cost of such reclamation can never be made: it would show up the perseverance and strong spirit of initiative possessed by the past generation of farmers who selected this extreme corner of the Po Valley for their operations. The names of Count Francesco Aventi, Count Luigi Gulinelli and Ing. Gerolamo Chizzolini — to mention only some of those no longer living — will always be remembered as among the numerous band of pioneers who devoted brains and money to carrying through this reclamation work. It should be repeated here that the fundamental work of engineering reclamation was performed on private initiative and with private capital at a time when the Government seemed almost ignorant of the existence of any such important problems. It was only after the passing of the law of 1882, modified in 1901, that the State took a part in the completion of the work.

It will still be possible to calculate what has been spent by the State and by local bodies in completion of the work, at any rate where such expenditure was undertaken to satisfy collective needs. But the total sum sunk by private persons defies all attempts at estimation, whether it be that expended on the large properties organized on industrial lines or that due to large, medium or small landowners.

Among the large organizations for intensive cultivation or industrial agriculture, special mention should be made of the Ferrara Land Reclamation Society and its derivatives — the Immobiliare Lodigiana, the Immo-

the Veneta and the Amministrazione Mazzotti, besides other smaller ones comprised in the Association for the Grande Bonifica — and of the Vallare and Valle Volta Societies, comprised in the 2nd section; all have been the subject of numerous publications and serve as objects for all engineers and agriculturists. No less worthy of mention are numerous farms whose present prosperity is the fruit of the labours which in the agricultural industry of the much abused class of large small Ferrarese landowners.

The fertility of the redeemed land, after it has been properly laid out, has often been referred to: yields per acre exceeding 37 bushels for 16 tons of beets and 12 cwt. of hemp lint are by no means exceptional.

There are still a few pieces of land, which as Prof. Munerati wrote some time ago, have not yet been awakened by phosphatic manuring, the application of scientific agriculture; such lands require an enormous expenditure of capital to bring them under cultivation, and they have tended and continue to absorb a large part of the returns given by the old lands.

In the early years of cultivation these lands were robbed by excessive growing: they form another example of the specialized agriculture which is started wherever virgin land is suddenly opened up for farming, known by the agricultural history of all countries. But this extensive cultivation had a short life; these reclaimed lands gradually came to resemble the densely populated old lands surrounding them, as regards the farming plan, the arrangement of the farms and the means of production. The tendency is to form farms of about 75 acres — the old-fashioned "suro" — which, at any rate in the early stages, are run on the "boarco" (1) contract system. Many private estates have already reached this condition, and modern necessities incline to still further reduction of the holdings, so as to make them suitable for farming on the métayer system or for letting to colonizing families. On the larger estates such a change exists only in theory, as the complex circumstances already mentioned prevent its being carried into practice.

We may finish up with a few statistics, which refer to the whole province of Ferrara and not only to the reclaimed areas. The following table

Crop	Average 1862-1871		Average 1909-1913	
	Per acre	Total	Per acre	Total
..... bushels	16.26	1 875 335	29.13	4 323 935
..... cwt.	6.3	294 375	9.0	619 900
..... tons	—	—	14.9	226 966

The "boarco" contract is one in which a head ploughman is put in charge of a number of teams of oxen; he is housed and receives part money wages and part in kind.

(Ed.)

gives the average yields of certain crops for the decade 1862-71 in comparison with the agricultural statistics for the 5-year period 1909-13.

The cattle numbered 70 000 in the 1869 census and 110 320 in the 1911 census.

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The Swine Raising Industry in Canada

by

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The swine raising industry in Canada is closely allied with what may termed general agriculture or mixed farming. Even the early settler raised a few hogs to supply themselves with meat and to provide a product acceptable to the local merchant in exchange for products of commerce. With the development of urban populations and the growth of the lumbering industry, there grew up a demand for pork products. In the case of the butcher very early became a necessary factor, while in the swine industry, the farm continued to combine the breeding and feeding operations with the slaughtering and curing of meat. Then there arose a more or less extensive fresh pork trade, but it was not until the packing houses were established about 1860 that an export trade began.

Of the early years of the industry, Mr. William Davies of Toronto, pioneer pork packer of Canada, writes:

Fifty years ago or even more, large numbers of dressed hogs were brought by train to Toronto. Besides the few that were bought by local dealers many were bought by commission men in the city for local operators in Montreal. These carcasses were chopped and packed in barrels with a certain amount of salt, then coopered up tight and filled with water and brine. These barrels were then shipped by boat to the consignees in Montreal. In a few instances they were taken down by local Toronto men. Arrived in Montreal the barrels of pork were taken to a Government Inspection Warehouse. The inspectors, sworn Government Officials and they made out a bill for each owner specifying so many barrels of mess pork, so many of prime mess, etc., and armed with this certified bill products could be sold to Montreal merchants, from whom the stuff found its way into pineries to feed the lumbermen. At that day there was positively no export trade.

that a reciprocity treaty with the United States was enacted and as hogs were much plentiful in the United States than in Canada, and mess pork in barrels was put up in the United States on a very large scale, it came to Canada duty free and thus there was a considerable surplus available for export, especially as the kind of hogs desirable for the lumbermen's use were "mammoths" while the sort desirable for export were the "weights". From that time the export business increased largely.

While the market for Canadian pork products was confined principally to home demand, there was no incentive to change from the customs that had become well established, but so soon as there was an appreciable quantity for export, the requirements of the importing country had to be reckoned with. It was, as it is today, the business of the farmer to raise the hogs, to find a market depended upon the commercial man, who, in this respect, was the pork packer. Fortunately for the industry, which expanded very rapidly, there were in Canada farseeing men engaged in the pack-business, and on these the swine raising industry depended more than on any other agency. They set about developing the right kind of hogs for the best trade.

The English market demanded medium weight hams and "Wiltshire" hogs full of lean meat. Experience taught the packers that the Yorkshire and Tamworth breeds excelled in these particulars. To encourage farmers to raise hogs of these breeds, leading packers imported boars and distributed them in hog raising sections. This was done in sections of Ontario about 1900. The result was very pronounced and in the desired direction, for in a few years Canadian hog meats became very popular on the British market.

The possibilities of the bacon industry appealed to Provincial and Dominion Governments perhaps more especially at the beginning. The Ontario Department of Agriculture during several years in the nineties conducted a most effective campaign on behalf of the "bacon" hog. By means of Inter Fairs and Farmer's Institute meetings, Ontario farmers were shown conclusively that the "bacon" hog was the most profitable to raise and the most readily sold in the best markets of the world. The correctness of the teaching in those days is amply borne out by the report of the Swine Commissioner who visited Denmark and found that the Danish pig, from which the highest-priced bacon in England is made, corresponds exactly to the pigs advocated for Canadian farmers and at the present time raised in every province. The results of this campaign of education were so pronounced that within a few years the railroads leading to the large packing houses were loading hogs at almost every country station once or twice weekly with stock that came well up to the standard for the export trade.

Nor were the other provinces asleep in regard to the swine breeding industry, as in each one of them excellent progress has been made, more especially in the matter of quality. In each and every province the "bacon" pig is the Standard and the pigs that win the best awards in the Eastern provinces are of the same general type, age and weight as those that take the best awards in Ontario and in the Western provinces.

The Federal Department of Agriculture has done much to improve the industry, more especially in the provinces outside of Ontario. Through the Branch of the Live Stock Commissioner the teaching commenced in Ontario has been extended to other parts of the Dominion both at Institute meetings and Winter Fairs, while these latter organizations have been induced to frame their prize lists so as to encourage only breeds of the "heavy" type. The Federal Department of Agriculture, in conjunction with other agencies, has also distributed by means of section sales and through Farmer's Clubs breeding swine of superior quality. Then the Experimental Farms have rendered and continue to render a highly valuable service in experiments carried on more especially at the Central Farm, where the questions of economical feeding and sanitary housing have been very largely solved.

The Export Trade.

From small beginnings in the early nineties, the export bacon trade with Great Britain grew by rapid strides until in 1905 Canada supplied the Mother Country with about 20 per cent of her imported bacon. For a number of years a highly satisfactory export trade was maintained, but since 1905 a decline has been in operation until Canadian supplies to the Old Land have fallen to about one-third what they were when the trade was at its height.

It must be noted that up to about 1884 much of the export pork was made from United States hogs. Soon after that time Canadian hogs were raised in sufficient number to keep the packing houses supplied.

The following table shows the exports of bacon, hams and pork from 1868 to the fall of 1913.

Exports of Bacon from Canada.

Fiscal Year	Bacon lbs.	Hams lbs.	Pork lbs.	Total lbs.
1868	—	10 580 528	3 506 048	14 086 576
1870	—	19 627 216	6 544 384	26 171 600
1880	8 616 739	955 603	1 281 391	10 853 733
1885	7 189 260	962 827	555 436	8 707 523
1890	7 235 336	256 746	233 899	7 725 981
1895	37 526 058	2 617 963	519 736	40 663 757
1900	132 175 088	2 856 186	1 109 550	136 141 824
1905	116 835 050	2 866 263	2 235 936	121 937 249
1908	92 001 910	3 173 950	769 932	95 945 792
1909	70 554 927	3 271 312	335 343	74 161 582
1910	45 576 883	3 242 806	599 081	49 418 770
1911	56 068 607	3 805 918	417 577	60 292 102
1912	59 979 953	3 124 595	434 480	63 539 028
1913	36 212 190	2 470 634	521 533	39 204 357
1913*	15 522 804	1 144 707	370 993	17 038 504

* April-October.

The falling off in exports does not indicate a serious decline in the raising of hogs. According to the Census of 1891 there were that year on Canadian farms 1 733 850 hogs, which number had increased ten years later to 2 353 828, and in 1911 to 3 610 428.

Federal meat inspection in Canada, which is confined to establishments engaged in export or inter-provincial trade, was inaugurated in September, 1907. The following table shows the number of hogs slaughtered in inspected establishments in Canada year by year since that time:

Swine Slaughtered in Canada at Inspected Establishments (T).

	Number
8 months ending March 31, 1908	861 989
Year ending March 31, 1909	1 532 796
" " " " 1910	1 261 496
" " " " 1911	1 452 237
" " " " 1912	1 852 997
" " " " 1913	1 607 741
10 Months ending January 31 1914	1 456 615

The decline in exports must, in large measure, be attributed to increased consumption in Canada. During the years of heavy export the supplies sent out were produced almost entirely in the Province of Ontario. The other provinces, while filling with people, were slow to produce hogs until at least two or three years, when a great increase in production has taken place.

Up to 1913 packing houses in Ontario and Quebec had a large share of the trade of the great lakes, but the tide has turned. Prairie provinces, owing to continued high prices for pork, have turned their attention more and more to the feeding of hogs on their low grade and damaged grain, and since the fall of 1913 have been shipping hogs east in large numbers. In 1913 the slaughtering of hogs in Canada showed a very slight increase over that for 1912. The killings in eastern houses showed a decrease which was slightly more than met by an increase in the west. This is borne out by statistics supplied by the Meat Inspection Division of the Department of Agriculture in the following table.

Hogs Slaughtered in Inspected Houses.

	1913	1912	Increase or Decrease
Eastern Canada	923 908	1 058 486	— 134 578
Western Canada	336 147	145 064	+ 191 083

The exports of hog products from Canada have, until quite recently, been almost entirely to Great Britain. With the coming into force of the "Wool-Tariff" in September, 1913, the markets of the United States have been opened to Canadian hog products.

A large number of swine are slaughtered in Canada in places other than those under federal inspection.

States of America were thrown open to meat products on a free basis. Since that time increasing quantities of Canadian bacon, hams and pork have been finding their way over this international boundary.

Pedigree Registration.

The registration of swine in Canada commenced with the Berkshire breed in 1875, but it was not until 1882 that other breeds commenced to be recorded. That year, a record was opened for Suffolks, Yorkshires and Tamworths, and at various periods up to 1892 practically all of the present breeds in Canada, with the exception of the Hampshires, were being recorded; Hampshire records were opened in 1910. The work of registration was carried on by the Agriculture and Arts Association of Ontario until about the year 1900, when that body ceased to exist. From that time until the National Live Stock Records were formed in 1905 (under the Live Stock Pedigree Act of 1901) the work of registration was done by the Henry Wade, Secretary of Live Stock Associations in Ontario.

Since 1905 the registration of swine in Canada has been carried on under the National Live Stock Records System at Ottawa.

The development of a Canadian "bacon" hog is strikingly reflected in pedigree registration. During the past thirteen years hogs of the "bacon" type have increased by leaps and bounds, those approaches that form have more than held their own, while certain breeds of the old thick type have passed off the stage so far as registration in Canada is concerned. The following table shows the number of pedigrees of each of several breeds that have been recorded up to 1900, the number of each recorded up to the beginning of 1914 and the number of each recorded at the beginning of the present century:

Pedigree registrations:

	Up to 1900	Up to 1914	No. since 1900
Berkshire	12 447	29 350	17 203
Yorkshire	6 681	46 393	39 712
Tamworth	2 398	10 063	7 665
Chester White	2 519	11 420	8 901
Duroc Jersey	706	2 363	1 657
Poland China	2 595	3 878	1 283
Hampshire	—	933	933
Essex	20	272	252
Suffolk	262	281	19
Victoria	14	—	—

Pure Bred Swine in Canada.

The following table compiled from Canadian Census returns of 1911 shows the numbers of pure bred swine in Canada, by provinces, in June of 1911 year:

Breeds	Alberta	British Columbia	Manitoba	New Brunswick	Nova Scotia	Ontario	Prince Edward Island	Quebec	Saskatchewan	Canada
Shire	1 771	342	1 995	235	187	7 455	246	740	918	13 889
ater White	23	39	62	301	52	1 665	112	1 901	42	4 197
ce Jersey	214	2	33	—	12	436	1	22	10	730
.	—	15	—	—	—	31	—	—	—	46
shire	2	70	20	1	—	664	4	153	2	916
l China	215	5	145	—	4	388	—	120	93	970
.	—	—	2	—	—	4	—	5	—	11
orth	141	53	363	41	—	2 996	1	634	64	4 293
hire	2 120	386	2 385	775	353	15 459	603	4 013	1 635	27 729
pecified	108	255	532	112	33	1 755	42	696	113	3 666
Total	4 594	1 167	5 537	1 465	661	30 853	1 099	8 284	2 877	56 447

SECOND PART.
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

- 806 - Courses of Instruction for Teachers in Rural Continuation Schools, Prussia. — *Zeitschrift für das ländliche Fortbildungsschulwesen in Preussen*, Year Part 9, pp. 397-398, Berlin, June 1914.
Special courses were to be held this year in 19 places in Prussia for instruction of teachers in rural continuation schools.

- 807 - Recent Experience in Farming on Moors. — Communication from DR. BJ. FEILITZEN, Director of the Experiment Station of the Swedish Moor Cultivation Association.

Among the recent works which deal with the nature of humic substances those of BAUMANN and GULLY, TACKE and SÜCHTING, RINDELL, OZSCHREINER (1), and SHOREY deserve to be mentioned, and on the chemistry of the nitrogen of moor soils the works of JODIDI, SUZUKI and VALM.

The formation of limonite and its explanation by AD. MAYER; RINDELL, led to a closer discussion of HAGLUND's so-called fire theory; to the explanation of the origin of sphagnum moors through the destruction of the moor forests by fire (2).

On the growth of peat, recent investigations in Sweden have shown that in a moor 36 inches of peat have been formed since 1540. J. AF ZEN measured in one locality a yearly increase of 1 inch of light sphagnum peat. According to TOLF this increase of peat on the surface of digging has no practical importance.

Concerning the chemical composition of various kinds of peat the following works may be mentioned: ZAILER and WILK on pure sphagnum peat; GULLY on species of sphagnum and sphagnum peat; PAUL on

(1) See No. 343, B. April 1913; also No. 311, B. April 1914.

(2) See No. 312, B. April 1914.

iphobe nature of sphagnum; and MINSEN on the various kinds of

The writer's own investigations have shown that the moor water in
ouched moors contains nearly one part of potash per 100 000.

As regards the microbiological properties of moor soils, KARSTEN
Jelsingfors has recently made experiments on the low power of conduct-
heat of moor soils in a dry and moist state. Interesting also are the
imum temperature readings which have been taken during the last
years at Flahult 4 inches above the surface of the soil on different
is near each other, over sandy soils, fens, and cultivated and unculti-
ed moors, in the months from May to October. They show what
siderable differences of temperature different irradiation of the soil
is in places quite close to each other.

Of great practical importance is the question of the draining of moor

On the moor at Flahult shallow drainage with ditches 2 feet deep
56 ft. apart, during five years, gave an average yield of hay 25 per
higher than that obtained from land drained by ditches 4 ft. deep.
shallow drainage the water-table stood, during the period of vegeta-
(May to October), at an average of 22 inches below the surface of the
le of the land between the ditches, while with the deeper drainage it
at 26 inches. The fluctuations of the water-table were in general
er with shallow than with deep drainage.

In experiments made in concrete basins in the experiment garden,
constant heights of water-table (8, 16, 24, 32 and 44 inches), the grass
in the first two years on sphagnum moor soil was highest when the
r-table stood at 8 and 16 in. and decreased rapidly with the lowering
e water-table. On the fen land the crop was heaviest with the water-
at 16 and 24 inches.

In the second experiment farm at Torestorp, experiments have been
urse for the last five years on the effect of varying distances (26, 40,
and 80 feet) between drains at equal depths (4 ft.). Hitherto no notice-
difference in the vegetation has been observed. The water-table
everywhere about 36 inches below the surface. In this direction
ations have recently been made also in Norway (Maeresmyren),
nia (Bernau) and Esthonia (Thoma).

On the importance of damming up the water in the ditches on moors
ican farmers in Michigan have collected evidence, and the Bremen
on recommends the practice in moor drains. Count BERG, at Sagnitz
nia), on the contrary, does not approve of it and recommends in-
the use of heavy rollers to prevent the excessive drying of the surface
or soil which has been rendered too loose by deep tillage.

The percolation of rainwater through well decomposed fen was found
meter experiments at Jönköping to be 90 per cent. on bare soil in
water half-year, and from 50 to 60 per cent on soil under vegetation.
corresponding figures were 40 and 10 to 30 per cent during the summer
ear.

For many years past a system of drainage has been practised in Sweden much resembling Butz' wooden pipe drainage (1); this latter system also has been used at Flahult with satisfactory results.

Experiments have been made during five years with lysimeters at Jönköping on the quantities of plant food carried away from moor soil by drainage water; they have shown that the losses on good fen land are much greater in uncultivated than in cultivated soil, and in arable land than under meadows. More lime and nitrogen are lost by unmanured than by manured soils. In the case of potash the losses were about the same, only traces of phosphoric acid were found. The losses of potash are by manuring amounted to from 2.23 lbs. to a maximum of 12.49 lbs. per acre per annum. The losses of lime reached 256 lbs. on arable land; 164 lbs. on meadows. A normal dressing of potash salts (38 per cent.) shows no increase of lime washed out over land without potash; this agrees with the Bromberg results.

The question of liming moors has been very exhaustively treated by DENSCHE (2) at Bremen and by SJÖLLEMA and HUDIG (3). Dr. NILSSON-BILSTEDT of the Swedish Seed-breeding Station at Svalöf, has demonstrated that dry-spot disease (*Scolecotrichum*) (4) attacks the various kinds of oats with different intensity and that greater or less resistance is hereditary; of varieties tested Improved Roslag and Mesdag were the most resistant while Tartar Flag and Improved Dala were very susceptible. According to Dr. HEDLUND, *Scolecotrichum* does not attack oats, and probably a saprophytic *Cladosporium* has been mistaken for it. The dry-spot disease or "Kalimangelkrankheit" (disease due to lack of potash) as Dr. Hedlund calls it, is probably caused by soil bacteria, as the plants are not attacked by it when the soil has been sterilized, for instance with carbon disulphide.

That lime must be finely powdered in order to produce the best effect has again been shown by recent experiments at Jönköping with powders of lime of several sizes of grain, in the course of which experiments the finest powder (passing through a sieve of less than 0.2 millimetre mesh) gave the heaviest yields (5).

Silicate of lime in Martin's slag proved almost equal to the carbonates. Among new implements for use on moors (6), the most important are heavy cement rollers (7), motor ploughs, Banke's new Swedish motor plough, Wassis and Hankmo Finnish harrows, the motor ploughs built by the Norrahammer factory and Faxé's moor shoes for horses.

Concerning manures it has been observed at Flahult that far from manure has a very feeble action during the first years of cultivation.

(1) See No. 229, *B.* March 1913 and No. 1324, *B.* Dec. 1913.

(2) See No. 1243, *B.* Nov. 1913.

(3) See No. 345, *B.* April 1913.

(4) See No. 575, *B.* June 1914.

(5) See also No. 17, *B.* Jan. 1914.

(6) See also No. 760, *B.* Aug. 1914.

(7) See No. 1067, *B.* Sept. 1913.

soils; after some years its effect was decidedly better, but much less than that of artificials. On the peat soils of a better class the effect of manure was more marked. A shallow ploughing in to a depth of two to four inches was better than to a depth of six inches. It was found that for turnips it was better to apply farmyard manure in spring than in autumn. The spreading of road sweepings is recommended by STEBER, and in Ontario, Canada, very good results appear to have been obtained by a cartload of garden earth to the acre. Green manuring with lupins gave very good results at Flahult; the residual effect was, however, very slight.

Among the bacterial cultures on the market, Azotogen and Kühn's *bio* in earth cultures have been beneficial on moor soils; on the con-liquid Nitragin proved uncertain. Earp-Thomas' Farmogerm (from Newfield, N. Y.) had very little effect on yellow lupins. Inoculation had a good and certain action.

The question of the effect of Leguminosae on Gramineae in mixed crops has been especially studied by TACKE, HILTNER, KASERER, LIPMAN, LYON, BIZZELL.

The investigations of BOTTOMLEY on *Myrica Gale* deserve to be mentioned here.

HÄGLUND, at the Jönköping Moor Experiment Station, tested the effects of artificials and lime on sphagnum and found that lime destroyed basic slag acted like lime but less energetically. Superphosphate on sphagnum. Kainit was somewhat caustic, but without any special effect, and nitrate of soda also acted weakly. The two latter, however, had an indirect action, as they encouraged growth of algae and lichens, thus hindering the formation of new shoots of sphagnum.

It is generally admitted that sedges dislike manuring, because manuring of meadows causes them to disappear; this is, however, the case and the apparent destruction of sedges is only due to their being smothered by the other plants. GÉZE, at Villefranche-de-Rouergue (France), has shown by direct manuring experiments, that sedges growing alone respond readily to phosphoric acid, nitrogen and lime.

At the Jönköping Moor Experiment Station experiments have been carried on for several years on the crops raised on the moors and on the quantities of plant food removed by them from the various moor soils; two years ago the results were published in a voluminous report. There are some discrepancies from WOLFF's figures respecting certain plants, but in the main the values agree well with the revised figures given by STUTZER in *Mentzel's Lengerkes landw. Kalender*. The writer's investigations did not lead him to confirm the high figures found by WAGNER and TACKE for the amount of phosphoric acid contained in hay; the figures found by PEDERSEN in Denmark, LENDE NJAS in Norway, and KRÜGER and STUTZ in Germany, agree with those of the writer.

Among the different phosphates Palmaer phosphate proved equal to superphosphate. Basic slag was tested in two series of experiments,

and its total effect, lasting three or four years, turned out clearly superior to that of superphosphate. In the Danish field experiments superphosphate and basic slag proved of equal value on field crops, but on meadows the former was somewhat superior. The after effects of basic slag were better than those of superphosphate. In moist years basic slag was better than in dry ones. Bone meal behaved almost as well as superphosphate on acid moor soils, but badly on alkaline soils. Tunisian phosphates, on newly cultivated moor land at Flahult, in two years of experiment, gave only one half the effect of basic slag. Vivianite proved almost as good as basic slag.

As for potash manures, the effect of phonolite (1) was only half that of Stassfurt salts.

Among recent experiments those with "Elektrokali" (2) and Jørgensen's carbonate of potash, as well as those on the substitution of potash by soda, and the works of WHEELER, SCHULTZE, WOHLTMANN and SÖDERBAUM on the effects of common salt deserve to be mentioned.

CROPS AND CULTIVATION.

808 - **An Improved CO_2 Psychrometer.** — SHAW, H. B. (Bureau of Plant Industry, U. S. Dep. of Agr.) in *The Plant World*, Vol. XVII, No. 6, pp. 183-185. Baltimore, June 1914.

A psychrometer (*i. e.* an instrument used by the U. S. Weather Bureau for measuring the relative humidity in given localities) is described which is designed for use amongst foliage and differs from other psychrometers in being provided with a protecting device preventing entanglement of the foliage while the thermometers are being whirled.

809 - **Distribution of Soil Particles.** — BEDFORD, DUKE OF, and PICKERING, S. P. *Fourteenth Report of the Woburn Experimental Fruit Farm*. London, 1914.

The distribution of the clay particles in a soil was determined in a series of experiments, carried out during a period of 14 months, in order to estimate the influence of the rainfall on such distribution. From a plot of ground 4 yards square which had received moderate dressings of artificial manures for the last 18 years, samples were drawn once a month in ten layers of 6 in. each down to a depth of 18 in. The samples were air-dried, sifted, and dried at 100°C .; then 40 gms. were shaken up with 40 cc. of water for 24 hours; after being allowed to settle, 200 cc. of the soil suspension were syphoned off and its clay content was estimated. The results obtained for the top 6 in. of soil are given below, together with the rainfall for the 20-day period preceding each sampling:

(1) See Prof. LEMMERMANN's article, in *B.* Oct. 1913, pp. 1486-1489; also *No. 500, B.* March 1913 and *No. 500, B.* June 1914.

(2) See *No. 420, B.* May 1914.

Month	Clay in uppermost 6 in. of soil		Rainfall during previous 20 days. in.
	per cent of soil. "Absolute"	per cent of total clay throughout the 18 in. of soil. "Relative"	
Jan.	0.52	23	1.35
Feb.	0.31	9	0.48
Mar.	0.26	11	1.21
Apr.	0.38	21	1.36
May	0.50	24	2.08
June	0.47	18	1.49
July	0.44	24	2.01
Aug.	0.56	29	1.70
Sept.	0.52	17	1.35
Oct.	0.31	16	0.68
Nov.	0.20	13	0.27
Dec.	0.40	20	2.33
Jan.	0.25	8	1.11
Feb.	0.46	18	2.65

The fluctuations in the "relative" clay content of the top layer of soil closely those of the rainfall except during the month of February when it is in an abnormally wet condition owing to the accumulation of water rainfall. If the "relative" proportion of clay in the top 6 in. of soil calculated on the two topmost layers alone, instead of on the whole of 18 in., then the figures, though following the rainfall fairly well, do so as well as when the proportion of clay in the topmost 6 in. of soil is considered in relation to the three layers; and from this it would appear the effect of the rain on the clay particles extends below the top 12 in. The total "absolute" amount of clay in the 18 in. is by no means constant; could indicate that the alteration in the proportion of the clay in the most layer is not due to differences of distribution, but rather to culation and flocculation caused by the rain; on the other hand, as the "absolute" amounts of clay in the top layer do not follow the fluctuation of rainfall as closely as the "relative" amounts, it would seem that in the flocculation and deflocculation are perhaps the most important of the rainfall, they are not the sole ones, and that some redistribution of particles also occurs.

The Number and Growth of Protozoa in Soil. — SHERMAN, J. M. (University of Wisconsin), in *Centralblatt für Bakteriologie, etc. II Abt.*, Vol. 41, No. 18/23, p. 625-630, Jena, July 22, 1914.

Thirteen soils from Wisconsin, Virginia and Tennessee were examined for protozoa by the dilution method, soil extract being used as the growing medium. It appeared from the results that all the soils contained at least

1000 protozoa per gram and that most probably even 10 000 per gram would still be a conservative estimate. Nearly all the organisms found were flagellates, but *Colpoda cucullus* and *C. steinii* occurred in two of the dilutions and *Balantiophorus elongatus* in one of them. No amoebae were found.

Sterilized soils were also inoculated with normal soil, proving good culture media even with a somewhat subnormal moisture content. After 15 days flagellates had multiplied in some cases to the extent of 1000 per gram of sterilized soil; ciliates on the other hand made no growth.

811 - **Relation of Bacterial Transformations of Soil Nitrogen to Nutrition of Citrus Plants.** — KELLERMAN, K. F., and WRIGHT, R. C. (Bureau of Plant Industry, U. S. Dep. of Agr.) in *Journal of Agricultural Research*, Vol. II, No. 2, pp. 202-204, Washington, D. C., May 1914.

The writers analysed the soils of certain citrus groves suffering from chlorosis in California and carried out greenhouse experiments in Washington, D. C., from which they obtained evidence that the falling yield of the citrus groves may be due to the toxic effects of very abundant nitrates.

812 - **Improvement of Waste Land in the Netherlands.** — MÜLLER, A., in *Der Landwirtschaftliche Presse*, Year XXXI, No. 57, pp. 701-702, Berlin, July 1914.

1. *Generalities.* — In the Netherlands the improvement of waste lands commenced in the first few decades of last century with the afforestation of heaths by individual landlords; some of these now form groups of fine closed woods. The growing interest in the improvement of unproductive lands led the parties concerned to the foundation of the Heath Improvement Society in 1888. At first the State limited its action to encouragement of private undertakings and to the fixation of the shifting dunes which were a menace to the community. It was only in 1911 after the institution of a special Forest Service, that the State began to purchase large extents of waste land and to put them under cultivation. It dealt chiefly with lands the improvement of which was impossible for the neighbouring cultivated areas but not suitable for private enterprise. At present the State Forest Service possesses 46400 acres of waste land and 12850 acres of cultivated land against 26 000 and 6600 in the year 1899. Further, the State assists the Communes in their work of improvement of waste lands by granting loans free of interest and by the technical direction of the work; the Heath Improvement Society also receives yearly State grants for the promotion of drainage schemes and for holding public courses in forestry.

2. *Treatment of heaths.* — a) *For permanent agricultural utilization.* The first operation generally consists in working with a steam plough to a depth of 6 to 12 inches; occasionally in uneven soils the spade is used. Then follows manuring, for instance with 6 to 8 cwt. per acre of basic slag and kainit, and yellow lupins and serradella are sown for a year or two. According to position and soil, oats and rye or potatoes and even peas are then grown. If the heath is suitable for meadow or pasture

longing is only 6 or 8 inches deep and is followed by harrowing. After drainage and levelling of the inequalities of the surface the soil is red; moor soils are frequently covered with a layer of sand 2 to 4 inches deep; grass and clover are then sown, often under oats or rye, sometimes after potatoes.

b) *For reafforestation.* — The areas suitable for forests are ploughed to a depth of about 16 inches, and where necessary drained by open ditches manured with artificials and green manure crops (yellow lupins). They are then mostly put under rye for one or two years (sometimes serflage is taken with it) or, on low-lying land, under oats. After this preparation one-year-old pines are planted at distances of 24 to 30 inches. If the locality is suitable, oak, elm, alder and other trees are planted in clumps or as borders.

3. *Fixation of shifting sands.* — While the heaths occupy about a million acres, the sands cover only about 125 000 acres. About seven-tenths of these are maritime dunes. Considering the importance of this area for agriculture, the State has taken possessions of four-tenths of the coast sands and three-tenths of the inland ones. In the districts of Haarlem and Hague some large dune areas have been afforested by private owners.

a) *Inland shifting sands.* — After roughly levelling the greatest inequalities of the surface of the sandhills the ground is partially or wholly covered to a depth of 12 to 20 inches. Then the soil is covered with cut heath, marram grass, peat or the like, on which a shovelful of sand is thrown at every step. Recently the areas to be afforested have been treated with various fertilizers, as well as with lupins, the straw of which has proved very useful for covering the soil. Two-year-old pines are then planted by means of iron planting-spades provided with a long and heavy blade which ensures the long pine roots reaching to the moist subsoil.

b) *Dunes.* — For fixing the dunes the Dutch use chiefly marram grass (*Ammophila arenaria*); plants preferably one or two years old are fully dug out and planted in clumps at distances of 20 in. \times 20 in. (slopes 12 in. \times 12 in.). As soon as the condition of the soil allows Austrian, Corsican and mountain pine are planted. In sheltered spots spruce pine is used with success, as well as pitch pine (*Pinus rigida*) and in some moist places oaks and alders. Where conditions are favourable the possibility of agricultural work is not neglected. Thus, for instance, the island of Texel, where for a long time sheep breeding has been practised on a large scale (about 30 000 lambs are exported every year), the most sheltered dunes have been devoted to grazing purposes.

- **A New Way of Utilizing the Energy of Peat Beds.** — ZAILER, V. in *Zeitschrift für Moorkultur und Torfverwertung*, Year XII, Part 3, pp. 89-91. Vienna, 1914.

In order to utilise the quantities of energy latent in peat beds, the construction of large central electric stations has been undertaken. These peats are burnt only dried peat. This is done in two different ways: the peat is either burnt directly in the fire-box of steam boilers and the steam is used to drive turbine dynamos, or it is burnt in gas generators and the gas used

in motors which transform the energy into electricity. Some of the generators obtain sulphate of ammonia as a by-product.

Of late another method has been adopted, to a certain extent combining the advantages of the two systems, and giving a still better utilisation of the energy contained in the fuel. This is the flameless surface combustion of generator gas under steam boilers. The process was invented at the same time in England and in Germany. It consists in leading a mixture of gas and air under low pressure through a certain mass of fuel which melts only at an exceedingly high temperature. In the interior of the mass an incandescent nucleus is formed which irradiates heat without forming flames. In England some boilers fired with this system have worked uninterruptedly for upwards of nine months, using water gas or coke gas. Any other similar gas can be used equally well. Whilst formerly it was considered satisfactory to produce 8 to 9 lbs. of steam from 1 sq. ft. of heating surface, with this method as much as 21.5 lbs. of steam can be produced from the same surface.

From the point of view of the exploitation of moors it is of great importance that no other fuel need be brought to heat the boilers.

The writer is of opinion that if this invention fulfils its promise a great step will have been made towards the solution of the problem of utilizing the energy latent in peat beds.

814 - Influence of Lime on Soil Bacteria. — MILLER, F., in *Zeitschrift für Gärbau und Physiologie*, Vol. IV, Part 3, pp. 194-206. Berlin, April 1914.

The writer contributes to the discussion of the question already examined in various quarters as to the influence of the compounds of lime upon the multiplication and the vital activity of soil bacteria. In the experiments the rather heavy soil of the experiment field of the Agricultural and Bacteriological Institute of the University of Göttingen was used. The soil was taken from the field when it was damp; it was then sifted and thoroughly mixed. The additions were calculated on the dry earth. Quicklime was added in a finely pulverized state and well mixed with the soil. It contained only 4.16 per cent. of CO_2 . The soil under examination contained 2.02 per cent. of CaO and 1.19 per cent. of CO_2 . An addition of 5 per cent. CaO made the soil noticeably warmer and additions of 3 and 5 per cent. increased the loss of water from the soil. The experiments led to the following principal results:

1. Additions of 0.3, 0.5 and 1 per cent. CaO caused at first a slight decrease in the numbers of bacteria and later an immense increase. The greater the addition of lime the longer the duration of the decrease but also all the more intense the increase when it finally set in.
2. The addition of 5 per cent. CaO hindered completely the growth of bacteria.
3. Quicklime in doses of more than 0.05 per cent. on loam rich in lime caused a reduction of nitrification. Doses of 0.01-0.06 per cent. on Bunter sandstone poor in lime have a stimulating effect in this direction.
4. Additions of quicklime up to 0.1 per cent. on sandy soils rich in lime

in lime diminished the formation of nitrate from ammonium sulphate, doses of 0.5 per cent. CaO stopped this process altogether.

Experiments on the Value of Nitrate of Guanidin and Nitrate of Urea in comparison with Nitrate of Soda and Nitrate of Ammonia. — WAGNER, P., in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXIX, Part 29, pp. 417-421, Berlin, July 18, 1914.

At the request of the German Agricultural Society's Committee on Manures the writer has tested the manurial value of nitrate of guanidin and of nitrate of urea, two new products derived from calcium cyanamide, which it is hoped can be placed upon the market at suitable prices. Samples of the two products, the former containing 40.29 per cent. and the latter 30.54 per cent. of nitrogen, were obtained by the writer from the "Oesterreichischer Verein chemische und metallurgische Produktion" of Aussig on the Elbe. The experiments were made on oats and French ryegrass.

1. Experiments on oats. — Fifty-two pots were used, each of them containing 46 lbs. of sandy soil of the following composition:

	per cent		per cent
red clay	20.6	Carbonate of lime	0.02
fine sand	19.4	Phosphoric acid	0.148
coarse sand	50.1	Potash	0.076
lime	9.9	Nitrogen	0.079

TABLE I

Manure	Dates of manuring			Total grams of nitrogen
	April 17, grams of nitrogen mixed with soil on sowing	May 27, grams of nitrogen dissolved in 1 litre of water and poured on soil	May 28, grams of nitrogen dissolved in 1 litre of water and poured on soil	
—	—	—	—	—
Nitrate of Guanidin	1.0	—	—	1.0
	1.0	—	—	1.0
	1.0	—	—	1.0
Nitrate of Urea	1.0	—	—	1.0
	1.0	0.5	—	1.5
	1.0	0.5	0.5	2.0
Nitrate of Soda	1.0	—	—	1.0
	1.0	0.5	—	1.5
	1.0	0.5	0.5	2.0
Nitrate of Ammonia	1.0	—	—	1.0
	1.0	0.5	—	1.5
	1.0	0.5	0.5	2.0

The four manures were given in doses of 1.0, 1.5 and 2.0 grams of nitrogen per pot. Each pot also received 5 grams of phosphoric acid in the form of basic slag, and 2 grams of potash as silicate of potash.

Table I gives the scheme of the experiment; Table II shows the results expressed as average increase in dry matter over the average of the control pots, which was 20.2 gms. of straw and 6.2 gms. of grain.

TABLE II.

Nitrogen given under the form of:	Increase in yield of straw due to manuring with			Increase in yield of grain due to manuring with		
	1 gr N	1.5 gr N	2.0 gr N	1 gr N	1.5 gr N	2.0 gr N
Nitrate of soda . . .	86.9	104.1	113.4	46.3	70.8	76.1
» of ammonia . . .	85.7	101.9	100.0	42.1	64.7	71.2
» of urea . . .	62.2	81.8	97.1	37.8	54.8	69.1
» of guanidin. . .	33.6	—	—	26.8	—	—

Taking the yields obtained with nitrate of soda as 100, the following relative values are found:

	grain	straw
Nitrate of guanidin.	39	58
» urea	72	82
» ammonia	99	91
» soda	100	100

2. *Experiments with French ryegrass.* — For these experiments 52 pots were used. The soil was the same as that for the experiments on oats. As basal manure 5 gms. of phosphoric acid as basic slag and 2 gms. of potash as silicate were mixed with the soil. To these amounts some more potash was added for the second cut and some phosphoric acid and potash for the third cut, so as to keep pace with the development of the plant. Three cuts were made. The manures under comparison were given in the preceding experiment, but only to the two first cuts, the third getting no nitrogen.

The injurious effect of nitrate of guanidin observed in the experiment with oats was not noticeable in these tests. The sum of the average increases given by the three series (2, 3 and 4 gms.), expressed as dry matter in the three cuts, was as follows (control 18.3 gms.);

	gms
Nitrate of guanidin.	312.0
» urea	350.9
» soda	358.8
» ammonia.	365.1

If the increase obtained with nitrate of soda be taken as 100, the following relative values are obtained :

Nitrate of guanidin.	87
» urea.	98
» soda	100
» ammonia	102

The writer concludes from these experiments that nitrate of urea can be recommended to farmers as a useful manure, provided the nitrogen in it is sold at about 20 per cent. cheaper than the nitrogen in nitrate of soda. It does not seem advisable to produce nitrate of guanidin as a commercial nitrogenous manure, as its effect was inferior to that of the other three nitrates and in the experiments with oats it was observed that this nitrogen compound was not favourable to plant growth.

- The Relation of Atmospheric Evaporating Power to Soil Moisture Content at Permanent Wilting in Plants. — SHIVE, J. W. and LIVINGSTONE, B. E. (Botanical contribution from the John Hopkins University, No 37) in *The Plant World* Vol. XVII, No. 4, pp. 81-121. Baltimore, Md., April 1914.

In their investigations on the point of permanent wilting in plants, EGGS and SHANTZ (1) showed that the moisture content of soils where this point had been reached was the same when the experiments were carried out in a damp chamber or in an unshaded green-house. CALDWELL, on the other hand, only obtained moisture residues similar to those calculated from the Briggs and Shantz formula when he grew his plants in a moist chamber. The present investigations were undertaken to determine the extent of the evaporative power of the atmosphere on the soil moisture content at the permanent wilting point. To this end plants were tested under five different conditions of atmospheric humidity: a) in the open, exposure I; b) in a cheese-cloth shelter, exposure II; c) in a lath shelter made of laths 3 cm. wide with 3 cm. spaces between the laths, exposure III; d) in a cheese-cloth shelter placed inside the lath shelter, exposure IV; e) in a glass chamber protected from direct sunlight and kept saturated with wet cloths, exposure V. The evaporation rate in each exposure was determined by means of a porous cup atmometer. The experiments were carried out at the Desert Laboratory of the Carnegie Institute, at Tucson, Arizona, in July-September 1913. Maize, *Phaseolus vulgaris* and *Capsicum annuum* were used as test plants; the soils employed consisted of a mixture 25 or of 50 per cent. of a local clay loam with a coarse river sand, or of the clay loam used alone.

The results are summarised in the table on the next page.

These results confirm those of Caldwell in that the higher the rate of evaporation, the higher the water content of the soil at the wilting point. Where the soil employed consisted of a mixture of sand and loam the values actually obtained for soil moisture were all higher than those calculated from the Briggs and Shantz formula, but where the pure loam

(1) See No. 20, B. Jan. 1914.

Test Plant	Exposure	Evaporation from surface cc p. hour	Soil used	Water content of soil at the percent wilting point		
				actual	calculated from Briggs and Shantz formula	ratio actual to calculated
Maize	V	0.3	25 % loam	4.30	3.80	1.1
	IV	1.5	75 % sand	5.48	"	1.4
	III	2.4		5.78	"	1.5
	II	3.0		6.04	"	1.5
	I	3.7		6.16	"	1.6
Phaseolus	V	0.2		4.70	"	1.1
	IV	2.3		5.36	"	1.4
	III	3.0		6.22	"	1.6
	II	3.6		5.73	"	1.5
	I	4.8		6.35	"	1.5
Capsicum	V	0.5		5.13	"	1.3
	IV	2.2		5.41	"	1.4
	III	3.2		5.85	"	1.5
	II	3.9		6.59	"	1.7
	I	6.1		7.17	"	1.5
Phaseolus	V	0.2	50 % loam	5.90	5.92	1.0
	IV	2.0	50 % sand	7.85	"	1.7
	III	3.3		8.16	"	1.7
	II	4.5		8.27	"	1.7
	I	5.8		8.37	"	1.4
Maize	V	0.1	100 % loam	10.99	12.52	0.8
	IV	0.6		11.89	—	0.9
	III	1.8		12.03	—	0.9
	II	2.6		12.95	—	1.0
	I	3.9		13.13	—	1.0

was employed the ratio actual: calculated started well below unity and only rose with increasing evaporation to a maximum of 1.05.

The writers discuss the interpretation of their results by means of formula.

- The Distribution of Stomata in the Seedlings of Some Gramineae. — ZAEFFEL, EDGAR, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 150, No. 2, pp. 205-207. Paris, July 13, 1914.

The writer has observed that in oats (*Avena sativa*) and in wheat (*Triticum vulgare*) the stomata are most numerous at the apex of the cotyledon, less numerous in the subapical belt and absent at the base of the cotyledon, while in *Panicum altissimum* and *Paspalum stoloniferum* stomata are throughout the length of the cotyledon and are not more numerous towards the apex.

Summarizing, in the Gramineae examined, stomata are absent in the hypocotylous belt, which is incapable of heliotropic perception. In the cotyledon of oats and wheat stomata abound at the apex, where the heliotropic sensibility is great. Stomata exist also, though in much smaller numbers, in the subapical belt, which possesses only a weak capacity of perception. In the cotyledon of *Panicum* and *Paspalum* the stomata are throughout the whole length, and the cotyledon is wholly sensible to light. The conclusion may therefore be drawn that in the Gramineae the abundance of stomata in young plants corresponds to their degree of heliotropic sensibility.

- The Resistance of Wheats to Winter (1). — HITIER, H., in *Journal d'Agriculture pratique*, Year 78, Vol. II, No. 29, pp. 82-84, Paris, July 16, 1914.

Last winter M. Schribaux made observations on the resistance to frost of various wheats at the Paris Seed Trial Station and in the field (noted) collections belonging to the Agricultural Institute. The following points were noted.

The varieties from Algeria and the extreme south of France and the wheats (Touzelles de Provence and Richelle of Naples) were completely destroyed. Then follow in increasing order of resistance: wheat from the north, Rieti, Belôtourka, Polish wheat, Black Russian Petanielle, Japhet, Bordeaux, Autumn Saumur, Saint Laud, Noël, Gros-Bleu and Pithivier (sown from Bordeaux). The hybrids Rieti × Japhet obtained by Schribaux proved decidedly less sensitive to the cold than their parents. Among English wheats (which stood the winter well) Hunter's was the most resistant.

Among the rivets, Nonette de Lausanne showed great resistance, but of the wheats examined, Alsatian wheat and the hybrids obtained from M. Schribaux (Red Alsatian × Bordeaux and Red Alsatian × Dekat, varieties which are now well fixed) are those that stood the cold best.

According to observations in several parts of France, M. Hitier believes that the damage done to the wheat by frost depends more upon the nature and physical condition of the soil than upon the varieties of wheat used. Heavy soils which had been beaten down by rain all the varieties suffered, while they resisted in permeable soils and in those that had not been pressed.

The greater susceptibility to damage by frost cannot always be attri-

(1) See also No. 620, B. July 1914.

buted to late sowing, because in several cases the last wheats sown were much better than those sown first. On one farm in the department Aisne and on another in Seine-et-Oise, it was observed that wheat was overtaken by frost before it had completely sprouted out of the soil, & very vigorously as soon as the thaw set in and did not suffer any further injury from the winter. Similar observations were made by M. Schreber in 1891 and by others also.

It seems that there is a critical period in which wheat is especially susceptible; it is when the radicle is ceasing activity and the adventitious roots have not yet had time to develop; the result is a want of moisture in the leaves.

It may be said, in conclusion, that a whole series of causes exists, which we do not yet know completely and which render a wheat resistant to cold.

819 - Report on the Field Trials with Barleys organized in 1913 by the Royal Station of the Brewers' Institute of Berlin. — VON ECKENBACH in *Deutsche Landwirtschaftliche Presse*, Year XXXXI, No. 50, pp. 625-628, June 24, 1914.

The comparative trials carried out in 1913 by the Barley-growing Station of the "Versuchs- und Lehranstalt für Brauerei" were intended to test the cultural value of various barleys for brewing purposes. They were made on 14 farms in North Germany, with the six following varieties:

1. Bethge's No. 2.
2. Mahndorf Improved Hanna (Strain C 8).
3. Heil's Improved Franconia.
4. Zeiner's Improved Franconia.
5. Ackermann's Improved Lower Bavarian "Danubia".
6. Ackermann's Improved Lower Bavarian "Bavaria".

Each variety was grown on at least two plots separated by plots of other varieties. No special manure was prescribed; in general, however, abundant quantities of potash and phosphoric acid were used with moderate dressings of nitrogen. The seeds used were obtained direct from the breeders.

The examination of the product was restricted to the following points: protein content of the dry matter, thousand-grain weight, and grade of the grain. The judges adopted the scoring usually followed in the malting of barley: protein content, weight and uniformity, ranging from 1 point (bad) to 18 (superfine). The nature of the husk and the color of the grain were also judged, 9 points being the maximum for the former and 5 for the latter.

The results of nine complete trials may be summarized as follows: The highest average yield of grain was given by Zeiner's Improved Franconia, with 3130 lbs. per acre, but it was rather subject to smut and liable to lodge. It was followed by Ackermann's Danubia (very resistant to smut, but liable to lodge) with 3105 lbs. per acre, and by Bethge's No. 2 (little subject to smut but a little inclined to lodge) with 3095 lbs. per acre. The fourth place was taken by Heil's Improved Franconia with 3040 lbs.

; this suffered much from smut but stood up well. Ackermann's Bavaria, with 3030 lbs. per acre, possessed great resistance to smut and did not e. Last of all was Mahndorf Hanna, which yielded 2945 lbs. per acre ; is fairly resistant to smut but liable to be badly laid. The points awarded to the above varieties for brewing quality were as follows :

Zeiner's Improved Franconia	60.1
Mahndorf Hanna	58.9
Heil's Improved Franconia	58.4
Ackermann's Bavaria	57.3
Ackermann's Danubia	54.4
Bethge's No. 2	54.3

— **Field Trials of Vegetables: Four Years' Trials of Green Peas, 1909 to 1912.** — SCHULTZE, W. — *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 253, 69 pp. Berlin, 1914.

The four years' field trials of green peas (1909-12), carried out on several eminent fields in the most important vegetable-growing districts in many, were intended to test the respective merits of the various kinds of peas as raw material for the canning industry, especially from the grower's point of view. Special importance was attached to the time of ripening, to its duration, and to the stature of the plants, as dwarf varieties that do not require staking are to be preferred for the smaller amount of labour and material they require. Consequently early-maturing dwarf varieties were tried side by side with late-maturing tall ones. The preparation of the soil, sowing and cultivation were in every case carried out according to local practice.

Results. — The yields of green peas are subject to much greater variations than those of cereals or hoed crops. These variations are due partly to differences in soil and weather conditions and partly to the varieties of peas grown. In the eleven varieties tried there were striking differences of stature, time of ripening and quality of the crop, so that in certain cases it was difficult to decide which to prefer, as frequently a drawback in one point was compensated for by an advantage in another. Some varieties, however, possess a decided superiority, as may be seen from the following :

1. *Monopol*: plant of low growth (does not require staking), early ripening; yield barely medium; ratio of the weight of the seeds to that of the hulls good; size of the peas good (the peas are sorted by two meshes, one of 7 mm. and the other of 8 ½ mm. mesh; the larger peas are esteemed for canning purposes).
2. *Stanley*: a marrowfat pea of low growth, very late; yield and ratio of peas to hulls low; small peas too numerous.
3. *Express*: medium growth, very early, medium to good yield; satisfactory ratio of peas to hulls; size of peas satisfactory.
4. *Ueberreich*: medium to tall growth, early, low yield; medium ratio of peas to hulls; size of peas unsatisfactory.
5. *Canning*: marrowfat pea, medium growth, late, low yield; good ratio of peas to hulls; small peas too numerous.

6. *Buchsbaum-Schnabel*: dwarf, very late, good yield, medium to good ratio, very good size.

7. *William Hurst*: marrowfat pea, low growth, early, low yield, good ratio, unsatisfactory size.

8. *Moringia White (Teutonia)*: marrowfat pea, low growth, very low good yield, medium to good ratio, size poor; very good for drying.

9. *Moringia Green*: marrowfat, medium growth, late, medium yield, good ratio, poor size.

10. *Grünbleibende Folger*: tall, mid-season, good ratio, average size.

11. *Improved Schnabel*: tall, mid-season; yield, ratio, and size: very good.

From the above it is evident that there are dwarf varieties that yield well and possess a good ratio and well formed peas. In general the early varieties have lower yields than the mid-season and late ones but they are less exacting as to soil and moisture. Owing to the shorter life the moisture they require when sown early is generally provided by the winter rainfall, which is not the case with later varieties, the yield of which is often endangered by dry weather, especially on light soil. The chief aims of practical plant breeding are thus seen to lie in the direction of combining early maturity with satisfactory yield.

The flavour of the peas is less dependent upon the variety grown than upon the weather and perhaps the soil and its state of cultivation.

221 — Physiological Correlations and Climatic Reactions in Alfalfa Breeding.

FREEMAN, G. F. (Agricultural Experiment Station, Phoenix, Arizona) in *The American Naturalist*, Vol. XLVIII, No. 570, pp. 353-368, Lancaster, Pa., June 1914.

During the season of 1910, 44 varieties of alfalfa were grown at the Arizona Experiment Station Farm; they were irrigated at the rate of over 6 in. of water for each cutting, and 6 cuttings were obtained during the season; these were studied with regard to yield and character of the hay and other points.

The correlation between the yield obtained at the first and subsequent cuttings takes the form of a curve beginning and ending high with a sag in the middle, which indicates the presence of some disturbing factor special noticeable at the fourth and fifth cuttings, and which appears to be the high temperature together with a slight deficiency of water. The presence of this factor is again evident in the disturbance of the normal correlation between the yield and the stand (number of plants on a unit area) at the fourth and fifth cuttings.

The 44 varieties are classified according to their morphological characters and geographical origin into the following groups: Mediterranean, Peruvian, European, American and Turkestan. The reaction of the different groups to the climatic conditions of Arizona is shown by plotting the differences between the average yield of each group and the total average yield at each cutting. The curves thus obtained show that there is a marked similarity between the European and Mediterranean alfalfa, though the better stand of the European varieties makes their yield always better than the yield of the Mediterranean ones; European varieties yield

largest relative crops at the fourth cut and then go off rapidly. Curves of the American and Turkestan groups are again much alike, Turkestan being slightly above the American strains; the yields of groups decrease earlier than the European varieties. The Peruvian, on the other hand are by far the best croppers at the end of the

Other correlations show how the nitrogen content of the hay is dependent on the high proportion of leaves in the hay and on the composition of leaves, but that the stand of the plant has no effect on the proportion of leaves in the hay, though this is always low when the plants are tall or the total yield of hay is high. Negative correlation was also shown between the height of plants and their stooling capacity (average of stems per acre).

Value of Turkestan Lucerne. — BOHUTINSKY, G., in *Monatsheft für Landwirtschaft*, Year VII, Part 3-4, pp. 73-81. Vienna and Leipzig, 1914.

ing to the increasing importation of Turkestan lucerne seed into comparative tests were made in the experiment field of the Royal Agricultural College at Krizevci between this seed and the Hungarian, the most important in Croatia. The soil is a heavy loam, containing 0.4 to 0.9 per cent. of lime; owing to its tenacity and capacity and to the abundant rainfall it is not the most suitable for growing

Nevertheless lucerne persists for five or six years, yielding from five cuts per year on land subjected to garden cultivation during preceding years, as was the case with the area on which the experiments were conducted.

This variety of seed was examined as to its germinating capacity and sown at the rate of 45 lbs. per acre on two plots each measuring 10 yds. As a cover crop a thin sowing of four-rowed barley was made. The barley was sown first; then the land was thoroughly harrowed. On April 8, 1909, the lucerne was sown. It came up well on the 14th. Growth of both kinds was normal and when the barley was harvested the two plots did not differ from each other in appearance. Only later, on the 18th plots, the Hungarian lucerne grew more rapidly and intensely and in the first year yielded a considerably heavier crop than the variety.

The experiment was continued during the three following years. In 1910, to the slower growth of the Turkestan lucerne the plots under this variety showed the very first year many more weeds than the other ones. In 1911, 20 varieties passed the winters 1909-10 and 1910-11 equally well, but during the winter 1911-12 the Turkestan lucerne, which was already thin towards the end of 1911, fell off further. In the spring of 1912, so thin that the plants could have been counted. On the other hand the Hungarian lucerne presented a completely closed surface.

In 1910 the first cut was made on both varieties at the same time, and in 1911, exceeding two cuts when each variety was in bloom. The yield was not equal, especially because the weeds also contributed to increase the yield of the Turkestan plots, and also because the first cut was somewhat

too late for the Hungarian variety. In 1911 the cuts were made when lucerne began to bloom; the result was that it gave five cuts with a considerably heavier yield than the Turkestan, which allowed of only four cuts. In 1912 both varieties were cut four times. The first cut of Turkestan, owing to the grass and weeds it contained, was more abundant than the Hungarian. In the other three cuts only the lucerne plants were weighed. In the second cut the grasses and weeds made nearly half. On the whole the yield of the Hungarian lucerne during the four years exceeded that of the Turkestan by 53 cwt. per acre, notwithstanding the fact that in the latter grasses and weeds were included except for the last three cuts of the year.

The chief result of the experiment was the demonstration of the slower aftergrowth of the Asiatic variety. The writer does not draw any conclusion regarding its shorter duration, as its slower growth favours the development of other grasses and this fact alone may lead to the disappearance of the lucerne. Its slowness of growth is alone enough to condemn it as unsuitable for leys.

In order to prevent the trade in this variety, the writer proposes that the seller should be always obliged to declare the origin of certain varieties and that the seed control stations should no longer seal the packages containing it: the Hungarian stations have since 1909 stopped sealing packages of this variety and have succeeded in the object aimed at.

823 - **Connection between Available Space, Weight and Sugar Content of Mangolds.** — MUNERATI, O., MEZZADROLI, T., and ZAPPAROLI, F. V., *Atti del 1° Congresso Italiano delle Industrie dello Zucchero e dell'Alcool*, Vol. 1, pp. 6-12. Bologna, April 1914.

In the experiments conducted during 1912 and 1913 three groups were formed: one consisted exclusively of sugar beets, the second of mangolds and the third of a mixture of the two. They were sown in a field and in boxes 6 ft. 6 in. square by 3 ft. 3 in. deep containing different kinds of soil. The seeds were all of the same kind, and were sown on the same day. The results are summarised as follows:

1. Between the available space for each plant and the weight of individual beets there is no constant connection. While usually beets with plenty of available space are larger, yet very fine beets are also found when the plants are close together, and the reverse also is often the case.
2. The weight which some beets attain depends markedly upon the soil and, in equal soils, upon the season.
3. Exceptionally large beets occur much more seldom when there is much available space upon poor soil than upon a rich one.

The above observations are equally true for beets, mangolds and semi-sugar beets.

4. Mangolds growing near beets do not affect the development of the latter.
5. Even in the most uniform soil imaginable (such as that in boxes) and with the same treatment, the same variations and differences occur.
6. The differences between individual plants growing in the

of soil appear also in the shape of the roots and behaviour of root.

7. Even in sugar content noticeable differences are observed in beets in the same soil. Not only does the percentage of sugar vary according to the weight and form of the roots, but beets of the same weight and growing in the same soil during the same period may present remarkable differences in the percentage of sugar they contain.

Coffee Cultivation in Uganda. — SMALL, W. (Department of Agriculture, Uganda) *Bulletin of the Imperial Institute*, Vol. XII, No. 2, pp. 242-250. London, April 1914.

Coffee is the staple crop of European planters in Uganda; exports sent from about 10 tons in 1908 to 167 tons in 1912-1913, and are increasing as the estates gradually come into bearing; the exports for the months ending December 31, 1913, were double those for the whole previous year. There were 4 568 acres under coffee and 2 659 acres under rubber and coffee in March 1913.

The indigenous coffee plant is *Coffea robusta*, but this is only cultivated by natives and consumed locally; Europeans plant the so-called Nyasaland Bourbon varieties, said to have been imported from Jamaica and Java respectively and both derived from *C. arabica*. Little care has been so far with seed selection, but both these varieties thrive well and give heavy crops the fourth year. The outbreak of coffee leaf disease at the end of 1912 and the epidemic in 1913 led planters to give some attention to the forms of coffee, and experiments are now being carried out with *C. arabica*, *C. stenophylla* and *C. robusta*. With regard to climate, soil and cultivation, Uganda is eminently adapted to the production of coffee.

The question of permanent shade in coffee plantations is still in the preliminary stage; results obtained up to the present have not been favourable to permanent shading, but the matter has not yet been given a sufficiently extensive trial. The silky oak (*Grevillea robusta* A. Cunn.) is being tested for this purpose and various species of Leguminous trees, also rubber trees which have the advantage of being profitable and the advantage of being subject to a root disease which also attacks coffee. The question of cover crops is also being investigated.

The strong, steady winds which occur periodically in certain parts of the country have to be guarded against, and high or low wind belts can be planted with various trees, bananas being a favourite subject as they provide shelter for the native population at the same time.

The *Hemileia* disease is endemic in Uganda and its appearance in the form of an epidemic in 1913 may be attributed to the fact that it was suddenly introduced with a new host plant; despite the prevalence of this disease, the outlook is favourable, for the indications are that its virulence will be less in the future than in the past; the fungus, being endemic in Uganda, is not expected to work the havoc that it has wrought in other countries where it was introduced. Planters are recognising that much depends on their efforts to eradicate it, and the Department of Agriculture is alive

to the situation. In dealing with white ants (termites), exterminators have been used with success. The ravages of these pests are unequal in some parts they have caused little or no damage to growing plants.

825 — **Production of Vanilla in the French Colonies.** — *Ministère des Colonies, Bulletin de l'Office Colonial*, Year 7, No. 77, pp. 209-249. Melun, May 1914.

Martinique. — Vanilla was introduced into this colony a long ago (about 1697), but its cultivation has not spread much and it is at present to remain stationary. During the four years from 1908 to the greatest exportation took place in 1909 (4 590 lbs., worth about £ the least in 1911 (2536 lbs., worth about £955).

Guadeloupe. — *Vanilla planifolia* was introduced in 1701; an pollination was begun in 1839, and a few years later the exportation began; in 1911 it amounted to 39 267 lbs., of the value of £11. The greatest quantity was exported in 1908: 68 242 lbs., worth £11. Besides Mexican vanilla (*V. planifolia*), the native vanilla (*V. pomplina*) also grown to some extent.

Guiana. — *Vanilla planifolia* was introduced about the year 1870. Administration of the penal settlement, but it did not gain a footing its cultivation is now abandoned.

Gaboon. — The cultivation of *V. planifolia* has developed gradually during the last fifteen years. The vanilla exported in 1911 was 89,000 lbs., worth about £1102. Vanilla has often been found wild in both French and Belgian Congo.

Mayotte and dependencies. — Vanilla has been cultivated in the Comoros Islands since 1875. At present it is the principal crop of the archipelago in 1909 the crop amounted to 91 525 lbs. The greatest quantity introduced by the island of Anjouan (1 200 000 plants); the quantity harvested in 1908 was 59 342 lbs., worth £32 031; the island of Mohéli gives the best quality. Mayotte possesses about half a million plants.

Madagascar and neighbouring islands (1). — Vanilla is not native to Madagascar, but it is now widely spread, especially along the east coast. The neighbourhood of Tamatave seems to be too moist for *V. planifolia*, but it is perhaps better suited for other species. In 1891 there were already at Antananarivo about 181 000 plants, and during the last two years this crop has attained real importance in the island, especially in the provinces of Voahery and Antananarivo, in the districts between Andovoranto and Mananyari. In Madagascar it does not encounter serious natural obstacles, but the market is limited and the island is not a competing centre of production, such as Réunion and the Comoros Islands, the plantations of which are in full bearing and producing a vanilla which enjoys great repute. The exports began to be important in 1911 they reached 115 589 lbs., worth £87 452. The vanilla of Nosy Be is especially renowned, but, like all Madagascar vanillas, is somewhat inferior in perfume.

Réunion. — Vanilla has been grown in this island for about a century.

(1) See also No. 635, B. July 1914.

It has also been exported for a long time, but it was only after 1862 that exportation became considerable. The so-called "vanillon" (the exportation of which began in 1884) is not *V. pompona* but the pods of *V. planifolia*, less than 5 1/2 inches in length. The cultivation of vanilla is somewhat increasing in Réunion, but the island still occupies one of the foremost positions among the countries producing this commodity. Almost the whole of the crop is exported. The graph of the exports from 1896 to 1911 presents two maxima, in 1898 and in 1902, respectively 442 046 lbs., worth £273 057, and 439 526 lbs., worth £107 196; in 1911 it was 146 610 lbs., worth £73 606.

Bourbon. — Vanilla is grown almost everywhere up to 100 ft. above sea level; it thrives better, however, in the windward part of the island than in the leeward. Bourbon vanilla ranks in the trade as a vanilla having a strong perfume, while in Mexican vanilla the perfume is delicate and sweet.

New Caledonia. — It appears that vanilla was introduced about 1861 and that only parts of the island are suitable to its cultivation. Experiments carried out on medium soils in the neighbourhood of Nouméa gave good results, but then the introduction of coffee raised more interest and vanilla was abandoned. In 1901 234 lbs., worth £127, were exported, but in 1911 only 2 lbs.

Tahiti. — *V. aromatica* was introduced in 1848 and is now widely cultivated. It is grown chiefly by the natives; the pods are picked too soon and in preparation leaves a good deal to be desired; the result is that the produce is sold at a low price, chiefly to Germany and the United States. In 1902, 318 525 lbs. were exported, representing a value of £47 493; in 1903, 289 761 lbs., worth £23 461. After 1904 the exports from Tahiti included in those from Oceania, which comprises Tahiti and Moorea. In 1911 it amounted to 467 567 lbs., worth £95 944.

French establishments in India. — At Pondicherry vanilla was introduced to the botanic gardens of the colony about 1879. The production began to be regular after 1888; it reached a maximum in 1901, with 280 lbs., worth £175. The soil and climate of the French establishments in India are not suitable to this crop, and the prices realized are not sufficiently remunerative.

Indo-China. — Vanilla was introduced about 1865 to the botanic gardens of Saigon, but it has not gained a footing in the country.

The exportation of vanilla from all the French colonies amounted in 1911 to 948 988 lbs., worth £389 832. The French colonies produce about two-thirds of the vanilla produced in the whole world. Its consumption in France between 1907 and 1912 was about 132 300 lbs. per annum.

— Nicotine in the By-products of the Cultivation of Tobacco (1). — CHUARD, E., and MELLER, R., in *Compte-rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 2, pp. 208-209. Paris, July 13, 1914.

Through the investigations carried out by the writers, in 1911, into the variation of the proportion of nicotine in the several organs of the

(1) See No. 1424, B. Oct. 1912.

tobacco plant during the course of development, it was ascertained that the offal of the crop as it is raised in Switzerland contains considerable quantities of the alkaloid. This waste consists of tips and axillary shoots before the leaves are gathered; stems, roots and shoots after the leaves are gathered. This waste, when used green, in order to avoid the loss of nicotine due to esiccation, is an important raw material for the preparation of the titrated solutions used as insecticides.

Experiments were undertaken in 1913 with a view to ascertaining the possibility of increasing the yield of nicotine in these waste products by suitably modifying the methods of cultivation of the plants and the treatment after the leaves had been gathered, without damaging the quality and the quantity of the chief product; the following methods were tried: 1) allowing the axillary shoots to grow instead of removing them as they appeared; 2) at harvest time gathering only the largest leaves, leaving in the ground all the stems provided with the recently formed shoots; 3) treating with nitrate of soda the plants thus partially deprived of the leaves.

From the analysis of the plants thus treated the writers draw the following conclusions:

1. The plants not deprived of their shoots are on the whole the most abundant producers of the alkaloid (1.305 gm. nicotine per untouched plant against 1.891 gm. in the others), and this independently of the serious harm done, by not removing the shoots, to the quantity and quality of the main crop.

2. The yield of nicotine of the plants left in the field after the harvest with the small shoots recently formed in the axils of the large leaves is much superior (0.942 gm. nicotine per whole plant against 0.432 gm. to that of the plants completely stripped).

3. Treating with nitrate of soda does not regularly modify the relative content of the different organs of the plant, but increases the absolute production of alkaloid per individual by favouring its growth (with nitrate 0.739 gm. nicotine per completely stripped plant and 1.288 gm. nicotine per partially stripped one). Thus nitrate is not a direct producer of nicotine (A. Mayer).

The writers conclude that it would not be advantageous, even from the point of view of the production of nicotine, to allow the growth of axillary shoots which are formed before picking, instead of removing them as they appear, but that the returns from the utilizable by-products (according to the method of cultivation adopted in Switzerland) may be considerably increased by giving nitrate of soda to the plants that are left standing after the harvest, during which they are deprived only of their large leaves.

Experiments in Growing Medicinal Plants at Korneuburg in 1913 (1). — Communication of the National Committee for the Encouragement of the Cultivation of Medicinal Plants in Austria, No. 17). SENFT, E. in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 3-4, pp. 129-182. Vienna, March-April 1914.

After some general observations on the cultivation of medicinal plants in Austria and on their disposal, the writer enumerates the chief pests which attacked them in 1913. Thus it is remarkable that white grubs infested almost all the poisonous and aromatic plants, such as *Atropa*, *Hyoscyamus*, *Datura*, *Angelica*, *Valeriana*, *Anacyclus*, *Pyrethrum* and *Levisticum*, and respected only *Conium* and *Levisticum*. He then gives detailed information on the sowing, manuring (in some cases), development, harvest and yield of the following plants: marsh mallow (*Althaea officinalis*), hollyhock (*Althaea rosea*), pyrethrum (*Anacyclus officinarum*), annual and biennial angelica (*Angelica archangelica*), *Anthemis nobilis*, wormwood (*Artemisia Absinthium*), estragon (*Trachycarpus*), deadly nightshade (*Atropa Belladonna*), blessed thistle (*Leucanthemum benedictus*), Caucasian pyrethrum (*Chrysanthemum [Pyrethrum] cinerariaefolium*), Dalmatian pyrethrum (*Chrysanthemum cinerariaefolium*), foxglove (*Digitalis purpurea*), yellow anemone (*Gentiana lutea*), *Grindelia robusta*, *Gypsophila paniculata*, *Hydrastis canadensis*, henbane (*Hyoscyamus niger*), hyssop (*Hyssopus vulgaris*), mullein (*Verbascum thapsus*), German iris (*Iris germanica*), lavender (*Lavandula officinalis*), lovage (*Levisticum*), liquorice (*Liquiritia*), mallow (*Althaea officinalis*), balm (*Melissa officinalis*), mints (*Mentha canadensis*, *M. sylvestris*), peppermint (*M. Piperita*), marjoram (*Origanum onites*), *Panax quinquefolium*, opium poppy (*Papaver somniferum*), *Petroselinum sativum*, rhubarb (*Rheum*), rue (*Ruta graveolens*), *Salvia officinalis*, sclary (*Salvia Sclarea*), soapwort (*Saponaria officinalis*), comfrey (*Symphytum officinale*), tansy (*Tanacetum vulgare*), *Thymus vulgaris*, valerian (*Valeriana officinalis*), mullein (*Verbascum thapsus*).

The number of species planted in the botanical garden during the year 1913 was 140. Among them there are some North American medicinal plants which thrive well, especially *Spigelia marylandica*, *Asarum canadense*, *Hamamelis virginiana*, *Grindelia robusta* and *Hydrastis canadensis*.

The Influence of Soil and Manures on the Yield, Chemical Composition, and Quality of Strawberries. — VERCIER, J., in *Journal de la Société Nationale d'Horticulture de France*, Vol. XV (4th Series), pp. 349-375. Paris, May 1914. — This was estimated not only for the fruit harvested during one season but also in the vegetative organs of the plant representing one year's growth; the following results were obtained (Table I):

(1) See also No. 1135, *B.* Oct. 1913; No. 1345, *B.* Dec. 1913; and pp. 26-30, *B.* Jan. 1914, by Dr. BELA PÁTER: Cultivation of Medicinal Plants in Hungary. (Ed.)

TABLE I. — *Removal of plant food from the soil by strawberries (lbs. per acre)*

	Total crop		Nitrogen	Phosphoric acid	Potash	Lime
	Green	Dry				
<i>Removed by fruit, including calyxes and peduncles:</i>						
in 10 English varieties . . .	13 400	4 800	45.32	41.46	43.40	21
(composition per 100 parts green weight)			(0.338)	(0.310)	(0.324)	(0.1)
in Alpine varieties	10 700	5 600	86.36	51.26	85.80	35
(composition per 100 parts green weight)			(0.806)	(0.478)	(0.801)	(0.2)
in 3 perpetual-fruited varieties	13 800	7 200	90.00	46.78	93.55	3
(composition per 100 parts green weight)			(0.650)	(0.338)	(0.676)	(0.2)
<i>Removed by vegetative organs:</i>						
in 10 English varieties . . .	3 200	1 200	13.91	11.80	13.67	1
(composition per 100 parts dry weight)			(1.17)	(1.00)	(1.15)	
in Alpine varieties	1 200	500	9.28	5.46	4.81	1
(composition per 100 parts dry weight)			(1.83)	(1.08)	(0.95)	
in 3 perpetual-fruited varieties	2 400	1 060	13.90	0.90	7.54	
(composition per 100 parts dry weight)			(1.30)	(0.85)	(0.71)	
<i>Total removed by crop:</i>						
in English varieties			59.23	53.26	57.07	
» Alpine »			95.64	56.72	90.61	
» perp. fruiting »			103.90	47.68	101.09	

The figures for phosphoric acid are relatively high, as the soils experimental fields were rich in this element.

The effect of manures. — The effect of different manures on the fruit was investigated on various soils; the results are given in Table II.

TABLE II. — *Average weight of strawberries (Sharples) in grams.*

Soil	Control	Complete manuring	No potash	No nitrogen	No phosphoric acid	Slag alone	Potash alone	Organic manures
.....	10.5	10.7	—	10.5	—	—	—	—
.....	10.4	—	—	—	—	10.6	—	—
.....	6.4	9.2	—	—	—	—	7.5	—
.....	9.5	9.6	11.8	9.4	10.1	—	—	12.5
.....	—	—	—	—	—	—	9.4	9.7
.....	8.3	8.6	—	—	—	8.3	8.9	9.3

The influence of manures on the period of ripening was also examined, though manured plots in general may be said to ripen earlier than unmanured plots, the various manures produced very irregular effects in connection.

The influence of manures on the flavour of the fruit is given in Table III:

TABLE III. — *Influence of manuring on flavour of strawberries.*

Manurial treatment	Points	Remarks
Unmanured	80	Typical flavour.
No nitrogen, but slag and sulphate of potash	60	Flavour reduced, not so sweet.
Complete manuring, slag, sulphate of potash and nitrate	63	Flavour reduced, very slight acidity.
No potash, but slag and nitrate	93.5	Very fine flavour, large fruits.
No phosphoric acid, but sulphate of potash and nitrate	75.5	Fairly sweet and with a pleasant taste.
Organic manure: compost, blood and cake residues	79	Fruit well filled and with a pleasant taste.

Though the absence of potash raises the quality of the fruit, it also raises the total amount of the crop.

The influence of manures on the chemical composition of the fruit given in Table IV.

TABLE IV. — *Influence of manuring on chemical composition of strawberries.*

Soil	Manurial treatment	Yield of juice, per cent.	Sugar, in gms. per litre	Acidity, in gms. of H ₂ SO ₄ per litre
A	Unmanured	54	63	6
	Dung	57	65	5.2
	Complete fertilizers and dung	56	73	5.9
	Slag and sulphate of potash	59	65	5.6
B	Unmanured	77	56	4.7
	Slag	68	67	5.0
C	Unmanured	54	63	6.0
	Potash	58	68	6.2
	Complete fertilizers and dung	56	56	5.5
	Dung	86	86	6.4
D	Slag and sulphate of potash	85.5	81	6.4
	Complete fertilizers	79.7	83	6.3
	Slag and nitrate	75.1	80	6.3
	Sulphate of potash and nitrate	81.3	80	6.3
	Compost, blood and cake residue	80.2	78	6.2

Influence of the soil on the fruit. — The following points for flav were awarded by expert tasters to samples of fruit grown on different soils; the two trials were carried out separately (see Table V).

TABLE V.

Variety	Soil	Points	Remarks
1st trial: Sharples	containing a fair amount of organic matter	80	typical.
	light sandy loam	109	best flavoured.
	low-lying sand	53	rather watery.
2nd trial: Vicomtesse Héricart de Thury	rich wheat land in good condition	30	slightly acid.
	very light, non calcareous . . .	39	full flavoured, fine dense.
	poor gravel	38	full flavoured.
	marly	26	flavour less good.
	gravelly sand with 9 per cent. carbonate and iron salts . . .	39	full flavoured.

Analyses of the fruit from different soils are given in Table VI.

TABLE VI.

Soil	Yield of juice per cent.	Gms. of sugar per litre	Acidity in gms. of H_2SO_4 per litre
Very sandy	57	65	5.2
Lying sand	77	56	4.7
Very hillside, unmanured for 5 years . .	54	63	6.0
Even	86	86	6.4

In another set of experiments the changes taking place during the maturation of the fruit were investigated and it was found that the acidity gradually diminished, while the amount of reducing sugars increased.

The chemical composition of 16 varieties is given and various schemes of manuring are discussed in the paper.

- **Fruit and Vine Growing in Central Asia.** — BARSACQ, JOS., in "Zapiski" Simferopolskaya Otdela I. R. obshchestva Sadovodstva, No 142, 1914.

I. *Fruit growing.* — In Russian Turkestan there are 20 123 dessiatines (632 acres) under fruit, mostly in the form of small native orchards, though of late years there has been a distinct tendency towards the establishment of larger orchards, up to 250 acres or more in extent, by the Russian colonists.

Of all fruits, *apricots* are the most common and are not only consumed locally in enormous quantities but also exported to Siberia; a succession of varieties assures a constant supply from May to August. The next most common fruit is the *peach*; a flat-fruited variety known as "Cheftalé injir" is very popular, while the local varieties of nectarines are better than the European varieties. *Mulberries* are an important crop not only for the sake of their fruit but also as food for silkworms; the large seeded seedless varieties are eaten raw, or made into a kind of sirup which is used as a sugar substitute, or even dried and made into a kind of flour which is used as a substitute for bread in very out-of-the-way districts. *Almond* trees are common in the forests of Ferghana, which, according to the most recent statistics, extend over 35 000 dessiatines (94 500 acres); nuts are represented chiefly by a large fruited and by an early dwarf variety. Local varieties of *apples* and *pears* are few and worthless, but European varieties, more particularly those cultivated in Crimea, have been introduced by Russian colonists and excellent results have been obtained in the Vierny district with Apont or Grand Alexandre; in the neighbourhood of the large Turkestan cities, especially Tashkent where fruit growing is developing with rapid strides, satisfactory varieties have yet to be selected, for shallow rooted stocks such as paradise or quince yield poor

specimens of trees and probably suffer from the great summer heat (up to 122° F.) and the drought.

As regards management, in order to keep down weeds, which are a serious pest, lucerne is sown in the orchards with excellent results; pruning is only practised in a very primitive fashion; the orchards are irrigated once or five times during the course of the summer. Flowering takes place about one month before it does in the Crimea, and late spring frosts are liable to cause very extensive damage, especially to the hard fruits.

With regard to diseases, codling moth (*Carpocapsa pomonella*) is by far the most destructive and affects up to 80 and 100 per cent. of the apples; this insect, though native, has few natural enemies and an attempt was made to introduce *Oophthora semblidis* and other of its internal parasites but without success. As the moth has three broods in a season, the late varieties of apples suffer most and 75 per cent. of their fruits are attacked as against 20 per cent. of the early varieties. Preventive and remedial measures employed successfully in other parts of the world, such as spraying, trapping, grease-banding, seem useless in Turkestan, but certain large growers have adopted the method of bagging their fruit and the practice seems to be spreading. *Tingis piri*, apple sucker (*Psylla*) and its allies, *Psylla adspersa* var. *pulverea*, *Melolontha afflicata*, *Rhizotrogus solstitialis*, *Tropinota turanica*, *Oxythyrea cinctella*, *Celonia marginicollis* also cause serious damage. Owing to the almost complete rainlessness of the summer fungoid pests are rare. Certain choice varieties of apples are frequently affected by so-called "Stippigkeit", which is thought to be of physiological origin though its cause is at present unknown; the disease is characterised by corky filaments under the epidermis which appear usually, after picking and it is spreading in a somewhat alarming manner.

Turkestan apples are inferior in quality to Crimean apples and the writer does not consider that the country will ever be capable of producing any but lower grade fruit; this produce will find an outlet in Siberia, which is being connected up direct with Turkestan by a railway. Early varieties of fruit will also be marketable in Russia, as they ripen about a month earlier than the crop in the European temperate regions.

II. *Vine growing*. — It is estimated that 25 000 dessiastines (67 acres) are at present under vines, of which 13 000 dessiastines (35 100 acres) are in the Samarkand district. Small vineyards are the rule. The writer gives a detailed account of cultural methods practised by the natives, including irrigation, which consists of five or six waterings during the summer.

As the Mahommedan law prohibits the use of wine, the varieties usually cultivated, amounting to about 40, are all table fruit with thick skins, few or no pips, and firm pulp; they grow in long loose bunches. About three quarters of the vineyards are planted with Kichnich, which is dried to produce currants. Masca is a very large kind with bunches averaging 3 lbs. in weight and sometimes reaching 10 lbs., while each grape has a diameter of 1 ½ in.; the fresh fruit is in good demand not only locally but also in Moscow and Petrograd. Khoussainé is a common variety in the neighbourhood of large cities and is exported to the

the name of Ladies'-fingers; it keeps well and is a heavy cropper, giving 1 000 to 3 000 poods per dessiatine (13 000 to 40 000 lbs. per acre).

Early varieties such as Ak-tchiliaku, which ripens at Tashkent in the middle of June, have also been cultivated of late years.

Russian colonists have tried certain European wine-making varieties, though the vines appear to have become thoroughly acclimatised and good crops, the wine is of poor quality.

The exportation of fresh grapes to Russia is capable of great development, and is receiving encouragement from the Government in the shape of supply of cold-storage trucks and an accelerated railway service; exports increased steadily since the opening of the Tashkent railway.

The dried raisin industry, too, is worthy of encouragement, for the climatic conditions are eminently suitable for the drying process and the wine could be vastly improved by the introduction of more up-to-date methods. About 1 250 000 poods (45 million lbs.) of dried raisins and currants are sent annually from Turkestan to Russia and another two million consumed by the latter country, are furnished by Persia and Greece; they might easily be produced in Turkestan.

Wine making, on the other hand, suffers on account of the great summat and excessive sweetness of the grapes and has made little progress. White wines are coarse and have a bitter after taste, especially when made with local table varieties; the writer is of opinion that ordinary table wine will never be greatly improved unless the processes of vinification are considerably modified, but there are great possibilities as regards the production of sweet wines with a high alcohol content. The manufacture of brandy has been attempted by a few firms, but without much success, as a coarse high coloured spirit has been obtained.

Phylloxera is unknown in Turkestan, while fungoid pests are rare, limited to *oidium* and *Cercospora*. The most serious enemies are the birds which destroy large quantities of grapes in some places; dogs do considerable damage, as they are rarely fed by their native owners and grapes represent a welcome addition to their diet.

LIVE STOCK AND BREEDING.

Experiments on the Control of Warble Flies in Germany (1). — SCHÖTTLER and GLASER, in *Mitteilungen des Ausschusses zur Bekämpfung der Dasselplie* 1, No. 6, 1-31, Berlin, 1914.

In 1913 the Warble Control Committee undertook the treatment of cattle in the district of Neuhaus on the Oste; out of a total of 3892 head, 2875, or 73.4 per cent., were freed from warbles; the number of larvae found was 47 625, that is an average of 16.2 warbles per head. The work was done in the second half of April shortly before the cattle were turned to pasture; the average time for dealing with each animal was a quarter

* also No. 534, B June 1914.

of an hour. The larvae were either squeezed out by hand or extracted by means of tweezers. Most of the cattle kept fairly quiet during operation, and in only 21 cases did a slight nettlerash follow. The total cost amounted to 423.70 M. (£20 15s 5d), or 0.89 Pfg. (0.11 d) per larva for each of the 3892 head of cattle existing in the district a little over 1 year. This is about the price paid formerly in Oldenburg for removing warbles from cattle. The cost, however, varied from one locality to another and with the number of cattle. Heifers and steers were the most affected with warbles, and cows had not so many, though they were certainly not free from them. Bulls had the lowest percentage of warbles. Considering the depreciation of each hide due to warbles to be 3.89 M. (3 s 9 $\frac{3}{4}$ d), the loss of the farmers in the district under consideration was about £ 560. If the reduction in the amount of flesh laid on and the check in the growth of the young cattle be also taken into account, the loss would probably be twice as much.

In a second part of their paper the writers report upon last year's campaign against warble flies in the district of the Wesermarsch Herd Association in the Grand-duchy of Oldenburg, where for several years it has been compulsory to free cattle from warbles. In order to give an idea of the success of the control of warbles the Chamber of Agriculture by means of the communal authorities, distributed among the owners of cattle upwards of 13 700 question-sheets; 3000 replies containing sufficient data were arranged statistically. The extraction of warbles in Oldenburg was carried out in most of the cases by the owners themselves and exceptionally by professionals, who in general were more successful than the former. The number of cattle to which the replies referred was 42 278, that is 40.60 per cent. of the whole stock of cattle in the district; of these 27 870 head or 64.43 per cent. bore warbles. The percentages were: cows 66.35, heifers 87.69, steers and bulls 85.81, and calves 8.58. In the herds examined there were 312 495 warbles, which would give 11.17 warbles per head for all the cattle of the district, or 7 or 8 per head of the whole stock, or 11 or 12 per animal infected. The lowest number was found on the cattle which had barely one each, while the cows had 4 or 5 and the steers 10 or 13. The total number of larvae killed was 204 184; the greatest loss from warbles was obtained where the operation was repeated in the autumn. On the "Geest" (high-lying land) pastures the cattle suffered more from warbles than on the marsh pastures on account of the greater dryness of the former. The same had been observed also at Neuhaus on the Geest.

Lastly the writers report an experiment made by them to demonstrate that the warble larvae caused the cattle to lay on less flesh. Ten cattle were kept under exactly the same conditions, five being freed from warbles and the others not. The result was that the former gained an average of 37.4 lbs. per head more than the others. Thus it appears that the loss in flesh caused by warbles is still greater than the loss caused by the warbles to the hides.

Effect of Long Storage of Meadow and Clover Hay on its Composition and Digestibility. — HONCAMP, MÜLLNER and STAU, in *Die landwirtschaftlichen Versuchsanstalten*, Vol. 84, Part 5-6, pp. 447-481. Berlin, June 16, 1914.

I. Meadow hay. — The hay used in this experiment had been kept for six weeks in a hay loft; it was then chaffed, uniformly mixed and wrapped in paper to prevent losses of any portion of it. After this was kept for three years in a large airy room not heated in the winter. Samples were analysed: 1) at the beginning of the experiment; 2) after a year and three-quarters; 3) after three years. The results of three analyses did not differ to any extent from each other.

In the digestibility trials, the hay was fed to two sheep at the rate of 4 lbs. per head per day at five different periods. The average coefficients of digestibility obtained are shown in Table I (averages of the two experiments).

TABLE I.

Period	Dry matter %	Organic matter %	Crude protein %	N-free extract %	Crude fat %	Crude fibre %
August 1909	58.9	60.8	68.0	59.6	48.2	59.8
17-June 1910 . . .	60.4	62.5	68.3	62.6	48.1	61.6
17-1911	59.6	61.3	69.6	60.5	46.0	59.7
February 1912 . . .	58.0	59.8	67.4	58.1	51.5	59.5
18-Sept. 1912 . . .	59.8	61.5	68.8	60.5	51.1	61 —
Coef. of digestibility in period as compared with 1st	0.9	0.7	0.8	0.9	2.9	1.2

The digestibility of meadow hay has thus remained very constant during the three years and has in no wise suffered from the long storage; variations of digestibility observed fall within the limits of experimental error. The writers conclude that by proper storage with suitable ventilation meadow hay does not suffer any loss either in its nutritive elements or in its digestibility, and that the different results obtained by different observers are due to losses caused by mechanical action, such as the rubbing of the leaves rich in nitrogen and consequent proportional increase of the more fibrous stalks, or by lack of proper precautions in handling.

II. Clover hay. — The clover hay used consisted of 60 per cent. clover and 40 per cent. ryegrass; it was chaffed and well mixed, part being wrapped in paper and part placed in a dry loft. It was kept for two years, and during this time did not show any change in its content of nutritive matter. In the experiments on its digestibility it was fed to two sheep in six different periods. The average coefficients of digestibility for the two sheep are given in Table II.

TABLE II.

Period	Organic matter %	Crude protein %	N-free extract %	Crude fat (Ether extract) %	Crude fibre %
I. July-Aug. 1911	62.9	65.0	66.0	58.9	56.5
II. Dec.-Jan. 1911-12	61.9	60.8	67.2	55.3	54.6
III. Sept. 1912	62.7	62.4	67.4	56.0	55.5
IV. Sept.-Oct. 1912	60.2	60.2	65.3	53.4	51.4
V. Sept. 1913	61.8	60.7	66.9	61.4	54.4
VI. Sept.-Oct. 1913	60.0	60.7	63.9	56.4	53.7
Decrease of digestibility in the 6th period as compared with the first	— 2.9	— 4.3	— 2.1	— 2.5	— 2.8

During the periods 1, 2, 3 and 5 the hay fed was taken from the pe wrappers and during periods 4 and 6 from the loft.

The differences in the digestibility during the various periods so small as to lie within the limits of experimental error. The writers therefore conclude that clover hay does not suffer any loss either in nutritive contents or in its digestibility.

With both meadow hay and clover hay the valuation according to botanical analysis agreed with that based on the digestible protein and the starch value; on the contrary valuation according to crude protein crude fibre content did not agree with valuation according to botanical analysis.

The classification of fodder is therefore to be based exclusively on content in digestible protein and starch value.

832 - **The Value of Different Kinds of Straw as Fodder.** — HONCAMP, RES MÜLLNER, in *Die landwirtschaftlichen Versuchsanstalten*, Vol. 84, Part 5-6, pp. 201 Berlin, June 16, 1914.

This is a critical study on the present views, mostly based upon experiments of Henneberg, Wolf and others, on the food value of different kinds of straw. The investigations dealt with the straw of bar oats, wheat, rye, spelt, peas, lupins, rape and colza. Each kind of straw was examined as to its content in organic matter (according to the methods) and inorganic matter and crude fibre (according to Kew Weender, Cross and Bevan); it was then fed to two sheep in order to ascertain its digestibility.

As the weather is said to influence the chemical composition of straw and also to a certain extent its digestibility, the straw of the very dry year 1911 was compared with that of the wet year 1912, as far as possible. In most cases the different straws were taken from the same farms.

straw was mixed with hay and 0.66 lb. of it was given to each sheep. The straw of Cruciferous and of Leguminous crops was fed at a rate of 1 lb. per day and mixed with beet-slices, soy-meal and hay. The results are summarised by the writer as follows:

1. The general opinion that spring grain straw is poorer in crude fibre than the corresponding winter grain straw is in many cases erroneous.
2. The weather conditions have in general a relatively small influence on the percentage of organic and inorganic matter in the different straws, at least this influence is not so marked as in fodders richer in protein.
3. König's crude fibre method gives mainly a pentosan free crude fibre which is not the case with Weender's method. To this is probably in many cases, the lower yield of crude fibre by the former method. König's method for the determination of pure cellulose is not correct; the method of Cross and Bevan is more trustworthy.
4. The straws of spring and winter grain can be considered of equal value as to their digestibility. The straw of Cruciferae (rape and colza) is inferior in value to cereal straw, while the straws of Cruciferae and of Leguminosae are about equal.
5. The value of a fodder is correctly expressed only by its starch content. The classification of fodders according to protein and crude fibre content leads in general to erroneous conclusions.

The Contribution of Bacteria to the Feces after Feeding Diets Free from Indigestible Components. — OSBORNE, T. B., and MENDEL, L. B. (Connecticut Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol. XVIII, No. 3, pp. 177-182. Baltimore, Md., July 1914.

The feces of 17 rats fed on various diets entirely free from indigestible components were investigated with a view to determining what proportion of excrement was made up of dead bacterial bodies. The special diet consisted of protein, starch, protein-free milk (1), and lard, so that it was possible to avoid the great difficulty always encountered in previous experiments of separating the bacterial cells from fragments of more or less undigested food. The feces were dried and ground; the powder obtained was then successively extracted with ether, alcohol (absolute and 80 per cent), 0.2 per cent. hydrochloric acid, and absolute alcohol containing 0.2 per cent. hydrochloric acid. The final residue varied from 22 to 41 per cent. of the dried feces and its nitrogen content calculated on an ash-free basis was fairly constant, amounting to from 10.7 to 12.5 per cent., which corresponds closely to numerous recorded analyses of bacterial cellular substance. Microscopical examination also suggested that the residue consisted of an almost uncontaminated mass of bacterial

834 - The Breeds of Horses in Norway. — Communication from CHR. WILHELMSEN, sent by the Directorate of Norway.

Under the action of the special conditions of Eastern Norway a special breed of horses, known under the name of Gudbrandsdal (a valley in Central Norway), has been developed. These horses are raised by the farmers.

As for its origin, it is most probably the most northern branch of the western horse. Its appearance and anatomical structure agrees greatly with those of the Danish Jutland and of the old Hessian horses. It agrees with the hypotheses as to the emigration of the human races, the native breed of the Gudbrandsdal foreign blood was introduced in the 17th and 18th centuries and during the first half of the 19th century. In the first two centuries it was especially Danish blood, chiefly coming from stallions from the old stud of Friedriksborg. Later, in the first half of the 19th century, only a relatively small amount of foreign blood was introduced and that of very different origins. The importation of a roughbred English stallion *Odin* is of special interest: its third generation included *Balder*, whose blood is at present diffused in all the Gudbrandsdal breed.

These horses are mostly bay or black; about 4 per cent are chestnut and 1 per cent cream, while white is quite exceptional. Specially marked animals are relatively rare. The stature of the stallions taken as an average of 90 four-year-old horses born between 1900 and 1904 was 15.5 inches. The mares are generally about 1 inch less.

The head is usually of average length, with a straight and broad forehead and well set ears. The neck is somewhat heavy for the size of the horse, and the head not very well set on. The chest, of average depth and a good breadth; the average girth of the above-mentioned 90 stallions was 74.02 inches. The withers are of a good shape. The back is inclined to be too long, but there are many specimens with a very handsome back. The ribs are well arched; the rump is somewhat sloping and of average length and breadth and on the same level as the withers. The tail is set on high. The thighs are well proportioned as to length and are muscular. Altogether the muscular system is well formed. The legs are of average length. The hocks are large, well shaped and clean forming a good angle. Occasionally turned in hocks occur. The cannon bones are of average length and clean, the pasterns short or medium and duly sloped; sometimes upright in stallions. The shoulder has a good position. The knee is well formed and strong; flat and knock knees never occur. The cannon bones of the fore limb are also clean; measured in the narrowest part, they averaged, in the 90 horses examined, 8.37 inches. The pasterns are of average length and duly sloped; occasionally defective positions are met with. The hoofs are of average size and of excellent quality; formerly they were often thin and flat owing to defective breeding, but now these defects have completely disappeared.

The action of these horses is regular, their trot long, but their

y elegant. It is a very suitable horse for the peasants, being and thrifty as to food.

are usually fed on hay, oats and rye bran; in some places forest re added but hay is always the principal food. Foals usually it 11 lbs. a day during the first winter and 13 to 20 the next three

The daily ration of oats is from 2 to 3 ½ lbs. during the first in the succeeding winters very little oats are fed, 2 to 3 lbs. of being given instead.

Throughout the whole summer the young animals are turned out and the brood mares are collected in droves of about 40, with lion, on the mountain pastures. These pastures belong to the r to private owners. The latter let them to associations or possession of their own. In 1907 the national stallions gave 85 to 95 per fertile matings on the pastures and only 68 to 77 per cent. in the

State assistance consists of grants to associations for the purchase ons. These grants amount in some cases to £ 100 or £ 150. The ideavours also to favour horse breeding by yearly shows, the most nt of which is held at Lillehammer at the end of April or begin-May; often as many as a hundred or a hundred and twenty stallions ected here. The greater number are sold, fetching from £ 150 o. Most of them remain in Norway, but a good number go to and Russia and of late years some have been sent to Austria. the Lillehammer show there are smaller national shows which erally held in the autumn and in which mares are more in evidence. ares which have had prizes or have been approved, obtain for five he right to pasture free with the national stallions. The price of a t horse varies between £ 35 and £ 44.

Studbook is kept by the State. The first volume appeared in the fifth this year. Only the stallions that have been awarded at the shows are entered. Exception may be made for a stallion ; good stock. Mares must be pure bred and must have already borne o a Gubbrandsdal stallion. Some conditions concerning their out-conformation have also been added.

Among the measures for encouraging horse breeding due to private ive, the numerous trotting societies which organize matches during nter must be noticed. Most of them are united in a large associa- Det norske Traverselskab " (The Norwegian Trotting Association). st races only pure bred Norwegian horses are allowed to compete. he native breed of Western Norway is called the Fjord breed. Its is not completely known; possibly it is a branch of the Celtic pony. Fjord is a wiry horse, standing 14 to 15 hands 1 in. high. Its coat post always whitish, but of different shades; from time to time also are met with. The head is small with a broad and straight forehead mall and very mobile ears. The neck is strong and the head well set The chest is deep and of average breadth. The withers are round, ck of average length, and the ribs well arched. The rump is slop-

ing and often not quite muscular enough. The tail is high set and in. The thighs are muscular and of satisfactory length; the hocks are also clean but their breadth is not always sufficient; they are often much turned in and the angle they form is not always ample enough. The cannon bones are of average length, and clean; the pasterns are short and set at a true angle. The shoulder is somewhat short and vertical; the neck and forearm are of medium length, the latter being often poor in muscle. The knee is well formed; the fore cannon bones are clean and well marked. The fore pasterns are short and generally well formed, though sometimes owing to defective breeding knock-kneed animals are met with. The hoofs are small and of excellent quality. The step both walking and trotting is rather short, but the rapid action allows a great speed to be maintained. These horses are very hardy and exceptionally enduring, frequently travel 50 to 70 miles in a day.

835 - Formation of a German Sheep-breeders' Union. — *Zeitschrift für Schafzucht*, Part 7, pp. 145-150. Hanover, July 1914.

On the occasion of the German Agricultural Society's Show at Hannover this year a Union of German sheep-breeders was founded (*Deutscher Schäferverband*) with the object of uniting all the existing associations of sheep-breeders and individual breeders in an association for further sheep breeding in Germany.

836 - The Angora Goat. — HELLER, L. L., in *U. S. Department of Agriculture, Farmer's Bulletin*, No. 573, pp. 1-16. Washington, April 27, 1914.

The value of the 1909 clip of mohair in the United States was \$900 that is nearly four times as much as in 1899. The number of fleeces of mohair rose from 454,932 in 1899 to 1,682,912 in 1909. Of this number 1,077,463 came from Texas, 155,980 from New Mexico and 14 from Oregon; Arizona and California each contributed upwards of 70 and Missouri was the only other State with over 20,000. The average weight per fleece was 3.7 lbs. in Oregon and 1.85 lb. in Texas. In the State many Angora goats are shorn twice a year, for which reason the value of mohair per head is undoubtedly above the census figure for the average weight per fleece in the State. Assuming that one third of the Angoras are shorn twice it would appear that in the United States the number of Angoras of shearing age was about one million.

During the last few years the breeding of these goats has increased in importance more than that of any other animal and it is now carried on almost everywhere in the States. Conditions are especially favourable in this branch of animal husbandry in the North-West, in which breed is so abundant, and where the Angora goat contributes greatly to the clearing of forest fires by clearing brush lands. American Angoras have been exported mostly from California to South Africa, Canada, and recently also to Brazil and the Argentine Republic. The first Angoras introduced into the Union were mostly crossed with common goats in order to obtain a larger and hardier animal. The first and second crosses showed but little mohair and much kemp, and five or six crosses with

as were necessary before a really superior animal was obtained. The fifth cross the product could be considered as pure bred Angoras. The writer does not consider it advisable to cross with common goats in order to obtain Angora flocks. He considers it better to import good animals and to keep them pure from other strains.

The Angora goats of the United States are generally pure white and light. Their ears are either partially erect or drooping. Their bodies are of a good constitution; they are symmetrically built, and with the exception of the inside of the upper part of the legs they are well coated with fleece. The demand is for fine quality, closely curled, very glossy, and as nearly as possible free from kemp.

The price of mohair has of late years much increased in the Union on account of the many usages to which it is put (manufacture of plush, overcoats, etc.). The weight of fleece for American Angoras ranges between 2 and 12 lbs. The fleece of a one-year-old goat weighs 2 1/2 lbs. The fleece is allowed to grow for 12 months the average length of which is about 10 inches. The total weight of the fleeces produced in the United States in 1913 amounted to nearly 5,000,000 lbs. The best fleeces come from the North-Western States. The average cash production per goat is, according to the North-West Angora Goat Association, \$1.75 with many as much as \$2.25 per annum. Besides this considerable production, the United States import, in round numbers, about 1,000,000 lbs. of mohair, which is on the average superior in quality to American produce.

The loss of weight in washing of the home hair is about 12 to 15 per cent, rather greater than that of the imported article. The skins of Angora goats with the hair attached are sometimes tanned in the United States and are used for rugs, carriage robes, etc. The flesh finds a ready market, especially in Kansas City. The average weight of the goats slaughtered is about 68 lbs.

Shearing takes place from February to March and the second clip from September or October in the South-West, and from March to April in the rest of the country.

The most important Angora breeding associations are the "American Angora Breeders' Association", the "National Mohair Growers' Association" and the "North-West Angora Goat Association".

Chicken Rearing, (1)—*The Journal of the Board of Agriculture*, Vol. XX, No. 12, pp. 1049-1057. London, March 1914.

The demonstration by Mr. F. G. Paynter of his system of producing poultry, which was commenced in December 1912 at Haslington near Crewe, under the auspices of the Board of Agriculture and Fisheries in conjunction with the Cheshire County Council, came to an end in November last. An area of 4 acres in the middle of a newly formed small village colony was devoted to the demonstration, and from that point of view was particularly suitable for the purpose.

(1) See also No. 160, B. Feb. 1913.

(Ed.).

During the whole time the demonstration lasted it was thrown open to the public. The Cheshire County Council appointed a temporary demonstrator whose chief duty it was to show people round and explain the system to them; the result of these and of other means to attract those for whose benefit the demonstration was designed, was that a large number of people visited Haslington Hall while the work was in progress.

Incubation was commenced in the beginning of December 1912 and terminated by the middle of the following July. Three incubators holding 340 eggs, and one holding 390 eggs were used. All the eggs were bought from various sources. The result of the incubation was as follows:

Number of eggs bought	9897
" " broken	294
" " infertile	1600
" " not hatched	3885
" of chicks obtained	4028
Percentage hatched on total number of eggs incubated	41
" of chickens hatched after allowing for broken and infertile eggs	51
Average cost of eggs per chicken hatched	4½d

The proportion of chickens hatched to eggs purchased was more than 54 per cent. This relatively small proportion was partly due to shaking in transit and it is probable that better results would have been obtained if reliable eggs could have been purchased locally.

From the incubators the chickens were removed to the brood and when they were seven weeks old they were removed to larger runs (100 × 10 yards) and housed in so-called "Sussex arks," where they stayed until about 16 weeks old, when they were ready for sale. They were adopted by Mr. Paynter for disposing of them was to contract beforehand for the sale of the whole of his output to a poulterer near London, at prices varying from 3s 9d in April to 2s 6d in September.

The number, values and weights of the chickens sold were as follows:

Number of birds sold	3471
Weight	13968 lbs.
Average weight of chickens when sold	4.024 lbs.
Value of birds sold	£496 8s 1d
Average price per pound	8½d

The following is a summary of the food consumed and of its cost:

	£	s	d
3437 lb. Chick feed	24	10	1
7071 " Biscuit meal	40	5	8
711 " Oatmeal	5	3	1
389 " Rice	3	2	3
1899 " Bran	6	18	9
2862 " Meat and fish meal	24	9	3
4475 " Barley meal	19	18	1
21210 " Sharps	77	6	7
18985 " Wheat with 10 per cent. of maize	68	3	5
	£269	17	5
Grit	5	10	0
Total food bill	£275	7	5

The profit and loss account shows a net profit of £55 1s 2d. This is very small, but it must be borne in mind that the work was seriously hindered with by the reception of so large a number of visitors, and that outlay was valued somewhat high. In practice a small holder would on several items, such as part of the work, and his profits would be

1. During the current year Mr. Paynter is conducting a similar demonstration in Cambridgeshire.

Experiments on Egg Laying in Different Breeds of Poultry. — (Eighty-fourth Report of the Royal Veterinary and Agricultural College Laboratory for Agricultural Experiments at Copenhagen). *Communicated to the International Institute of Agriculture by the Correspondent for Denmark.*

The object of these experiments was: 1) to determine the difference in yield of eggs of various breeds of poultry; 2) to throw light on several questions of fertility of the eggs and on the colour of the shells.

1. Experiments were carried on for three years on the egg laying of the following breeds: White Leghorn, Brown Leghorn, Barred Plymouth Rock, White Wyandotte, Black Minorca and Houdan. The Leghorns took first place for both number and total weight of the eggs. While the average number of eggs laid by the Leghorns during the three years was 110, the Plymouth Rocks laid about 70, the White Wyandottes about 60, the Black Minorcas about 90 and the Houdans about 80. The results for the last three breeds, however, are only approximative as in 1901 of the pens disease was rife.

In comparative trials of Brown Leghorns, Nassaus and Orpingtons, the latter gave the highest yields, followed by the Leghorns, the Nassaus being last. Considering only one-year-old hens the Nassaus and especially the Orpingtons laid more eggs than the Leghorns, but if the two to year-old hens be included in the amount the result is somewhat favourable to the Leghorns. The good result with Orpingtons is attributed not only to relatively better laying, but especially to a uniform distribution over the individual months in the year.

2. As to the most profitable age for egg laying it has not been possible to determine any sure rule. Most hens lay the greatest number of eggs during the first or second year, but there were some that produced in the third year. In general it may be considered that the greatest number of eggs is obtained during the first year.

3. As for summer and winter laying there is no large difference between Plymouth Rocks and Leghorns, the former laying a slightly larger percentage of their eggs during the winter months than the latter. It has also been observed that the older hens lay a smaller percentage of their eggs during the winter months than the younger ones.

4. The weight of individual eggs was greater for Minorcas and Houdans than for White Wyandottes and Leghorns. It seems as if the weight of the eggs increased with the age of the hen.

5. Repeated weighing has shown that the weight of the birds increases with age, but only up to the end of the second year, when they are

fully grown. Within each year the weight of the body seems to follow certain laws, according to which it grows from autumn to spring and shrinks again during spring and summer. This is especially noticeable in good layers, the body weight of which decreases to a greater extent than that of the bad layers during the spring months when egg laying is more active.

6. From the observations made, it appears that broodiness, which is more frequent among Plymouth Rocks than among Leghorns, is more pronounced in the best layers.

7. The above experiments have further shown that 16 days after mating the hens still lay fertile eggs. When mating is repeated after a period of more than 16 days, the first fertile egg is generally laid three or four days later.

It has not been possible to influence the colour of the egg shell by pairing a cock of a breed which has yellow or brown eggs with a hen of another breed that lays white eggs, or viceversa. The breed of the cock is alone responsible for the colour of the egg shell.

The number of eggs laid, as given in paragraph 1, will be somewhat low and there are doubtless many flocks of poultry in Indo-China that lay more eggs. One of the reasons of the relatively low number of eggs obtained during these experiments is that for the sake of other flocks the poor layers, which a private breeder would soon get rid of, had to be kept. Thus, for instance while one Plymouth Rock laid in the years 200, 177 and 182 eggs, another one laid during the same time 2,5 and 4 eggs respectively.

839 - Contribution to the Study of Sericulture in Indo-China. — BOUTHER, in *Bulletin économique de l'Indo-Chine*, Year 16, Nos. 101 and 102, pp. 178 and 375-401. Hanoi, Hanoi, March, April, May, June 1913.

Silkworm breeding was introduced into Annam from China about the tenth century. It was encouraged by the Annamese emperors, especially Gia-Long and Minh-Mang, and soon became a flourishing industry in the peninsula, continuing in this condition up to 1851, after which date progress ceased. The French administration, notwithstanding its efforts, has not yet succeeded in giving sericulture in Indo-China the development which the good natural conditions of the country would allow; on the contrary the industry has even declined. This state of things is due to deep-seated economic and social causes:

1. The intense literary culture, which induces the educated Annamese to take up administrative careers (as mandarins) and to neglect agriculture and industry.

2. The improvements in the European cotton industry, which provides Indo-China with cheap and good cotton goods that have in many cases taken the place of the old silk tissues.

3. The natives were formerly taxed, by the mandarin administration, arbitrarily and according to their apparent wealth; consequently they did not dare to use the fine Chinese silks which would have made them out to the rapacity of the mandarins. Under the French administration they have abandoned the Indo-Chinese silks in favour of the Chinese.

and of late years they have made much use of Lyons and Japanese notwithstanding their higher prices.

4. The neglect of the cultivation of mulberries for that of rice, the being easier to sell than cocoons; besides which there is no doubt the diseases to which silkworms are liable have discouraged many breeders.

At the time of the French conquest, according to Dr. TURC, great quantities of production existed in the huyen of Kien-duong (now Cai-fây, Kien and Rach-gâm) in the province of Dinh-tuong (Mytho); the districts of Rach-gâm and Bentré, which sent their produce to the great market of Vinh; in the east of Cochinchina the districts of Baria, Long-thanh and Thuan-mot; at present next to nothing remains of the great plantations. In 1883 the French spinning mills were started at Cholon, but they had to be abandoned on account of the fall in prices on the Lyons market. In 1883 the Government nominated a mission for the reorganization of sericulture and created a silkworm breeding establishment at Cholon, in which an attempt was made to improve the native worms by crossing with foreign breeds. The results were bad, and the same was the case with all attempts at crossing Chinese or Japanese worms. M. VIREL believes that these failures are due to the fact that the native worms, being more slender, can eliminate more vapour better than the French, Chinese, or Japanese worms, which are fatter and consequently present a smaller evaporating skin surface in proportion to their weight; he does not think that there has been, as has often been asserted, any degeneration of the Indo-Chinese worms. He believes also that breeders have launched thoughtlessly into the system of crossing, which, if it had been preceded by study and systematic experiments on the best breeds more akin to the native breeds, might have yielded better results.

In 1905 a silk specialist was entrusted by the Governor-General with a mission which resulted in the formation of a French company; this led into an agreement with Indo-China for the selection and free distribution of silkworm eggs to the natives by means of subscription. The spinning mills of Nam-dinh were resumed and the breeding farm of Thanh-thuong, which was managed by M. VIREL, was attached to it. The latter came to the conclusion, from the experiments he made, that it was better to keep to the improvement of the Annamese breeds and to teach the natives how to rear the worms. At the same time reeling basins of European pattern were simplified for the natives. These basins, the cost of which is not above 12 shillings, were given free of charge to the natives; a Lyonsese employee of the Agricultural Service, a silk specialist, was instructed to teach them the way of using them.

All these efforts are beginning to bear fruit and already the quality of the silk exported to the mother country is improving. Indo-China has followed the rapid progress of Japan; even Corea and Siam have developed their sericulture. Indo-China, which has a population well adapted to this kind of industry and which might make use of the scientific results

acquired by the mother country, will also see a great increase in silk production.

Geographical distribution of sericulture in Indo-China.

The whole of Indo-China raises silk, but the delta districts take the lead.

Tonking. — The provinces in which silkworms are reared on a large scale are the following, arranged according to their importance: Nam-dinh, Thai-binh, Bac-ninh, Phu-lien, Phu-lang-thuong, Phu-ly, Hung-yen, Hanoi and Son-tay. Mulberries are grown in the alluvial lands, on the banks of rivers (Red river, Song-thai-binh, Song-thuong, etc.). Reeling and weaving are practised especially at Nam-dinh and Thai-binh. There are at Phu-lien flourishing plantations and important native weaving factories (Do-son, Kien-an).

Annam. — Sericulture is practised in all the provinces, but in the south (Khánh-hóa, Phú-yên) and in the north (Thánh-hóa, Quang-binh) it has rather declined; it has markedly progressed in the centre in Binh-dinh and Quang-nam. At Phu-phong, in the province of Binh-dinh, there is a great industrial spinning and weaving centre. Silk raising has declined in the province of Thua-thien, the only centres being the huyen of Phu-vang and the district of Thien-mô, which are not very important.

Cochin-China. — The silk industry is more widely spread but in a more backward state than in Tonking. There are no European factories and the attempt made twenty years ago by commander COLBERT DE TURGIS at Tan-chau to establish a station for killing the pupae in the cocoons failed. There are, however, about 3700 acres of mulberry plantations and all the silk industry is in the hands of small native growers and is at the same level as it was two thousand years ago. There are also some important centres of mulberry growing and silkworm rearing in the province of Cambodia, especially in the mountainous district about Thai-son, Tu-tê, and Tonkin, where the inhabitants are chiefly Cambodians. The island of Cochinchina and the Malay canton of Châu-giang form an important spinning and weaving centre. In the province of Long-xuyên, the mulberry belt extends from Cu-lao-giêng to the Ongchuong canal, including the village of Long-diên and others, as well as some islands round Cu-lao-giêng. The village of Cho-tu-chên-sai is the most important centre of this district (and perhaps of the whole of Cochin-China), exporting its silks (generally dyed black especially into the provinces of Càn-tho, Rach-giá and Bac-lieu. The province of Sadec, formerly renowned for its worked silks called "lụa không-tren," has to day only Ia-vung as centre, and this is of no great importance. The course of the Mékong has then to be followed as far as Bentré (Batri and Mocay) before the mulberry is again met with a kind of taffeta called "lụa", which formerly had a certain reputation, woven there. In the provinces of Bac-lieu, Soc-trang and Tra-vinh all the silk industry is in the hands of Cambodians; the Cambodian centres of Tra-kha, Tra-cu (Tra-vinh), Vinh-châu, Vinh-phuoc (Bac-lieu), Lai-tâm, Tra-

ap. Phuoc-lai and Yên-táp (Soc-trang) cultivate mulberries, breed worms and weave the silk.

Cambodia.—All the banks of the Mékong between Tân-châu and Pnom-penh are planted with mulberries in the parts that are inundated every year. On the borders of Cochin-China is the silk centre of Banam, in the province of Prey-veng, which has raised worms from the eggs of the Station Takeo (Pnom-penh).

The Upper Mékong seems to have a certain future before it from the agricultural point of view; silk raising is much scattered; the resources of Laos are imperfectly known, and unfortunately the attempts made in Siam and Cochin-China have not been extended to this locality.

The breeds of silkworms in Indo-China.

They are polyvoltine, generally with yellow cocoons, exceptionally dirty white. It requires 18 to 20 lbs. of fresh cocoons to produce 1 lb. of raw silk reeled after the European fashion. The complete evolution of the worms takes from 42 to 46 days: 10 for hatching the eggs, 20 to 30 according to the temperature for the growth of the worms and from 10 to 11 for spinning and reeling.

Annamese breeders distinguish the following four breeds: Bân-bi, Tân-diêu, Ken-se and Tăm-soc; their characters however are badly defined. The writer gives some of them. The Tonking breeds are generally of larger size.

Silkworm rearing.

The writer studies the native systems in order to draw the attention of European breeders who would improve their defective details.

The breeders themselves attend to the egg-laying; the unit adopted is the "cup" (the quantity of eggs laid by 4 or 5 fertilized female moths together under a cup). No selection is practised. Native breeders generally undertake the raising of a number of worms too great for their available space. Their yields are not remarkable, 22 to 28 lbs. of cocoons for 100 layings, and often less.

Incubation does not require any special care. Hibernation is not practised. The eggs have only to be protected against red ants. Annamese breeders remove the newly hatched worms only in the afternoon or the day after the first eggs are hatched, which has the effect of obliging those that hatched first to fast until the late ones come out. The young worms are swept off with a feather, many being injured in the process.

Moulting lasts 24 hours; the longest of the stages, the last, is of eight days. The food of the worms is frequently very imperfectly chopped and may contain fragments of wood which wound many worms. The worms are set to spin their cocoons on hurdles which yield up to 11 lbs. of cocoons each.

The breeder does not usually spin the silk, but sells his cocoons to a spinner at current prices minus a rebate of 1d per 11 lbs. in favour of the

spinner. When the worms have thriven well and produced cocoons saleable for reproduction they fetch as much as twice the price paid for cocoons for spinning.

The defects of native breeders are the following. They hatch out a quantity of eggs much superior to their means (this applies specially to the Cochinchinese); being short of hands they hurry roughly through the various operations, causing injury to the worms; this injury is then attributed to occult powers, which the breeders seek to appease by superstitious practices instead of improving their methods of breeding. The most elementary rules of hygiene are unknown; the diseased worms are thrown about anywhere and become new sources of infection.

Diseases and enemies of silkworms in Indo-China. — The most widespread diseases are: "pébrine," "grasserie," "flacherie" and "muscardine"; a fly called "con-lang" also causes a good deal of damage.

Pébrine, called in Tonking "tam-gai", causes much less havoc in Indo-China than in France. It is beginning to decrease owing to a free distribution of selected eggs; the sale of unselected eggs should be forbidden and more lectures for the natives should be given.

Flacherie, called "tam-lung" in Tonking and "tam-di-duor" in Cochinchina, appears especially in the last stages.

Some worms cannot digest their food and die without exhaling a characteristic odour of flacherie; under the microscope they show haze in moniliform strings.

Another disease, called "tam-kuong" in Tonking, causes the worm stretch out, and the third to the sixth ring to blacken; the last rings become transparent; the worm then dies and exhales a fetid odour.

Grasserie appears under various aspects, according to which it has various names; it is especially frequent in moist and stormy weather. It causes much havoc and often destroys whole batches of worms.

Muscardine is rather rare in Indo-China and is not much dreaded by native breeders.

The "red disease" is not very serious; it attacks the moths which die after having laid a limited number of eggs.

The fly "con-lang" deposits its eggs on the worms and secretes at the same time a corrosive liquid which attacks the skin and makes an opening in it, through which the egg penetrates into the worm where the leech feeds on the tissues of its host, reducing them to pulp; one worm can contain as many as 6 or 7 larvae. When the latter are fully developed they emerge from the body of the worm by a large opening and enter into the crevices of the floor, where they pupate. The pupa is at first light brown, then black and it develops in about 12 days. In order to guard against this insect, breeders protect the worms during the first stages by a mosquito curtain. In Tonking the windows are closed by a fine bamboo network. This fly is in its turn parasitized by *Encyrtus sericophilus* (Hymenoptera), the study of which has been the object of a communication to the Académie des Sciences of Paris.

another fly, called "rui dâ", which resembles a wasp, attacks the silkworms when placed on the hurdles to spin their cocoons; its sting is instantly fatal, but the damage it does is insignificant.

The silk industry.

Although the industry is established throughout the country it is still in a very backward condition. Spinning in the European fashion is not practised by the natives; there are in Indo-China only three filatures, two belonging to Frenchmen at Nam-dinh (Tonking) and at Phuphong (Annam); the third at Thai-binh (Tonking) belongs to a native company. All three lack an improved plant.

The Annamese systems of spinning produce a raw silk unacceptable for European markets.

The unit of cocoons in the filature is the "cân" of 11 lbs.; the unit of weight for the cocoon trade in Tonking is a bundle of 600 "sapeks" (sân-tiên), weighing 3.25 lbs., but considered in the French trade as 10 lbs. The unit for raw silk in skeins is 10 taels, or 9.25 lbs.

The thread of the cocoon that is formed in damp weather often breaks during reeling; it yields a fluffy silk of inferior quality and is used to adulterate spun silk for export.

The floss is sold to the Chinese, who export it to Cholon, whence it appears in a certain quantity is sent to France to the silk by-product factories. It is estimated that in Indo-China the floss pays the labour and the firing of the spinning mills.

The raw silk obtained in Cochin-China is useless in Europe; the "to-lua" quality is utilized by the local looms, while the "to-be" quality is exported by the Malays to Bangkok.

Annam silk is exported to Hongkong and Singapore. Tonking silk, having been improved thanks to the combined efforts of the Administration and the Nam-dinh mills, finds its way in increasing quantities to France, although at first-fifths of it still goes to Hongkong.

The native production is very low and is not sufficient for present needs; consequently it does not seek other outlets. Nevertheless the efforts made by the neighbouring countries, especially Siam, the Philippines and Corea, to extend their production, render considerable efforts in the same direction necessary on the part of Indo-China. But there are several obstacles to be overcome: 1) the lack of a technical direction not fully endowed by the administration; 2) the want of European facilities in Cochin-China and in Cambodia; 3) the ignorance of the natives in reeling and especially of the spinners, and their lack of initiative; 4) the want of capital, interest on which is almost always 50 per cent. and profits, often reaching 100 per cent.

The first steps towards progress must be made by the administrative authorities. The following would be useful measures:

1. Promoting in Cochin-China and in Cambodia the formation of societies for reeling silk, under the technical direction of French specialists. Such societies have given excellent results in Tonking.

2. Providing the natives with improved spinning apparatus, as already been done in Tonking, and granting prizes either to the spinners or to the exporters according to experience.

3. Teaching the Annamese to reel off a fixed number of the with knolled ends, replacing bamboo reels by aluminium ones, increase the twist and adjusting better the motion of the combs. A great deal of tact and a full knowledge of the industry are necessary in the officials are to induce the natives to adopt these measures, which would considerably increase the value of Indo-Chinese silks even on Asiatic markets and secure profitable sales for raw silks.

4. The awarding of prizes in money and honours by the Government.

Native weaving. — Silk is woven everywhere in Indo-China, but the processes are not equally developed in all centres; Tonking and Annam are more advanced than Lower Cochin-China.

In Tonking weaving is especially prosperous in the provinces of Ninh-dinh, Thai-binh and Kiên-an. Dô-son is renowned for its silks, a kind of taffeta called "lua"; in the province of Hà-dông the village of Lạc-dinh is distinguished for its gauze called "the La-ca". With the exception of the gauzes, taffetas, serges and satins which compete with the same Chinese woven goods, the natives turn to China for their finest garments. Of the Indo-Chinese countries, Cochin-China is the one which consumes the greatest quantity of Chinese silks.

In Annam, fine satins, gauzes and crapes are woven at Binh-dinh. The importation into France of Binh-dinh crapes continues to increase.

In Cochin-China weaving is limited to plain silks and some kinds with very small patterns. The most important looms of Cochin-China and Cambodia are those of the orphanage of Cu-lao-giêng, managed by the Sisters of the Apostolic Mission: here taffetas are made with patterns in Cambodian or Siamese style, 28 and 32 inches wide, as well as trousseaux (foulards and shawls) with French hand embroidery. Tissues of the same kind are manufactured by the Malay cantons of Xom-châ-và (or Xom-châ-giang) over against Châu-doc. The same Malays excel in the manufacture of "sampots" called "chàng hung" (a special kind of taffeta).

Indo-Chinese mulberries: their diseases and pests.

The mulberry cultivated in Indo-China is the white mulberry. There are many varieties of it, which have not yet been studied from the botanical or the nutritive point of view. The native varieties may be reduced to four: "dâu-tau", with leaves cordate, thin, entire or lightly serrate; "dâu-phung", with trifid leaves; "dâu-se", small cordate leaves; "dâu-du" (papaw mulberry), with leaves deeply divided, somewhat like those of the papaw.

Enemies. — In the mountainous region of Châm-doc, where the mulberries are grown as standards, occurs a longicorn beetle, the larva of which

holes in the trunk; this insect has no special name among the Annamese perfect insect gnaws rings in the bark of the branches. The writer found in 1908 in the province of Ben-co some mulberries injured from the attacks of an aphid lodged in the underground parts of the bark and the wood: the bark dries and falls off the parts attacked.

Termites cause serious damage to the mulberries planted on the dunes, "giông".

The mulberries on the banks of the Mékong at Tân-châu are attacked every year in the dry season by a fungoid disease which curls up the leaves and kills them, rendering them useless. The trunks of the trees attacked swellings and become brittle. The natives do not do anything to cure the disease, which disappears as soon as the rains come.

Fraudulent Introduction of Dead Lobsters in the Parcels sent to Market by Certain Breeders. — JUGEAT in *L'Hygiène de la viande et du lait*, Year 8, No. 7, 341-343. Paris, July 10, 1914.

The wholesale death of lobsters caused in the breeding basins by the high salt content of the water due to accidental infiltration of sea water, causes considerable losses to the breeders, a certain number of whom do not hesitate to mix these dead lobsters with the live ones in the parcels they send to market, especially to Paris, where the writer on one occasion seized no less than 295 lbs. of them. The flesh of these animals is of very inferior quality; it is lean, dry, friable and tasteless; it turns brown on being cooked and putrefies rapidly. It is therefore important to recognize such lobsters at once. Their characters are as follows:

1. *External characters.* — The muscles are completely relaxed, the membranes of the articulations are thick, dull and whitish (instead of being shiny and transparent) and turn black in a few hours.

2. *Internal characters.* — The tissues are soft and swollen with water. When the membrane is cut, water flows from the aperture, which never occurs when the animal is taken alive from the breeding basin.

FARM ENGINEERING.

Trial of Machine Ploughing in Rice Fields. — TARCHETTI, A., in *Il Giornale di Agricoltura*, Year IV, Nos. 5, 7 and 8, pp. 65-80, 103-107 and 122-128. Vercelli, March 15, April 15 and 30, 1914.

The Italian Experiment Station for Rice Growing at Vercelli organized a trial of machine ploughing in ricefields which took place on March 30, 1914, at Eusebio Saviolo's estate at Sali Vercellese, near Vercelli. Upwards of 100 acres of land were placed at the disposal of the Committee; the fields were very uniform and large, so that the average length of the furrows was about 1000 feet, and the plot assigned to each machine about 7 1/2 acres. The following eight machines were admitted to the competition:

Motor-hauled ploughs

BARONCELLI, of Ravenna, Italy; FERRETTI GOGGIA, of Tortona, Italy.

B. Self-contained motor ploughs PAVESI TOLOTTI, of Milan, Italy; S. of Berlin, Prussia.

C. Cable-hauled ploughs CASALI, of Suzzara, Italy; SANTACHIARA, of Reggio Emilia, Italy; VIOLATI-TESCARA, of Ariano Polesine, Italy.

D. Rotary digger V. MEYENBURG, of Bâle, Switzerland.

1. *Baroncelli's motor*. — 24 H P. (effective), 800 revolutions per minute, total weight 3960 lbs. — Has been somewhat modified to meet the special requirements of rice fields; the diameters of the wheels have been increased, as well as the breadth of their tyres.

2. *Ferretti-Goggi motor*. — 24 to 30 effective H P., 500 revolutions per minute, total weight 9 900 lbs. — Its wheels are on the Lefebvre-Holt Caterpillar system; that is they run on an endless chain of steel plates.

3. *Pavesi and Tolotti's "moto-aratrice"* or self-contained plough. — 16 to 20 effective H P., 700 to 800 revolutions per minute, total weight 4180 lbs. — In this machine the steering wheel has been enlarged and the tyres have been widened.

4. *Stöcke's motor plough*. — 42 to 50 HP, 700 revolutions, total weight 11 000 lbs. — This machine has also been somewhat modified to meet the special work before it.

The three cable-hauled machines (5, 6 and 7) are all on the single-engine system, with a separate windlass bearing two drums and a cable running round the field, though they differ in the construction of windlasses and in other particulars.

5. *Casali's apparatus* was presented with a 13 effective HP, 1000 rpm oil motor, built by the National Gas Engine Co. (Ashton); the two-wheel windlass truck, with 1600 to 2000 feet of wire cable, weighs 3 550 lbs.

6. *Santachiara's* windlass was presented with a Garret 12 effective HP steam engine; it is mounted on a four-wheeled truck and weighs with 1600 feet of wire cable, 3960 lbs.

7. *Violati-Tescara's* outfit was entered with two different motors: one is a heavy oil Mietz and Weiss 25 effective HP motor, and the other an electric three-phase motor of the same horse-power.

8. *Meyenburg's rotary digger*. — 25 effective HP, 1000 revolutions per minute; the drum bearing the diggers makes 180 revolutions per minute. Its total weight is 4400 lbs. and its breadth of work 6 1/2 ft.

Of the above outfits, Nos. 3, 4 and 8 require only one man to operate them, while Nos. 1 and 2 require two men and Nos. 6 and 7 require four.

All the machines entered finished off the work allotted to them, except the electric motor of No. 7, which did not arrive in time for the trial on March 30.

The points given by each of the 19 judges were 70, distributed as follows:

20 for quality of the work done

20 " cost

10 " ease and safety of handling and transporting

10 " regularity of work of motor and suitability to other purposes

10 " construction and solidity.

70

the following were the awards :

Group of cable-hauled outfits:

CASALI	1 222 points
VIOLATI-TESCARA	1 215 "
SANTACHIARA	1 102 "

Group of direct-traction outfits:

BARONCELLI	1 170 points
STOCK	1 108 "
PAVESI-TOLOTTI	1 051 "
FERRETTI-GOGGI	960 "

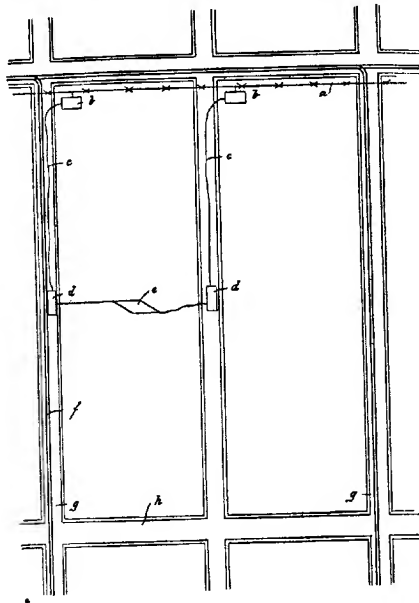
Experience with Motor Ploughs in the Cultivation of Moor Soil. — *Proceedings of the 72nd Sitzung der Central-Moor-Commission vom 15-17 Dezember 1913, pp. 164-202 21 figs. Berlin.*

In the 72nd sitting of the Central Moor Commission, four members, Ramm, Herr Volckmann of Kienberg, Herr Schmig of Hitzin and Falke of Leipzig, reported upon their practical experience with motor ploughs. The earliest experiments were those begun in 1907 at Wiesbaden; electric machines were used, as the steam ploughs then existing were too heavy. The division of the land to be worked into fields is shown in the accompanying figure. The arrangement of the electric line at right angles to the roads requires long cables, but on the other hand saves expense on the permanent lines and on the roads. When each field is provided with 2300 feet of cable, cross-roads are required only 600 feet. With steam ploughing the arrangement is the same. After several trials, satisfactory results have been obtained. Plough-electricity costs from 5 s 11 d to 6 s 8 d per acre; a steam engine working itself along the moor roads and burning peat costs 5 s 7 1/2 d per acre. The lower figures represent the cost with favourable conditions and with a long duration of work.

According to the experience gained the windlass (anchor) trucks were constructed in such a way that they did not require a road to be made for them. In order to prevent their being dragged sideways by the powerful cable put upon them they are fitted with large hook-like attachments which press against the side of the ditch on the edge of the field and slide like a sledge when the truck moves forward.

With regards the ploughshare, experiments are now being made in order to ascertain whether a share which turns the furrow-slice completely over has been found suitable (in fens) is advisable for these moors.

Experiments with cable-hauled disk-harrows have been successful also with rollers also. For roller work, with the exception of that on rough ploughed land, motor rollers are now used and have proved successful. They can be made heavier at will and are so arranged that they can haul a manure spreader at the same time.

Arrangement of moor land for electric ploughing at Wiesmoor.

EXPLANATION.

- | | |
|-----------------------|----------------------------|
| a. Electric line. | e. Plough. |
| b. Transformer truck. | f. Portable field railway. |
| c. Cable. | g. Sanded road. |
| d. Electric windlass. | h. Road not sanded. |

Each plot measures 550×1540 yds.

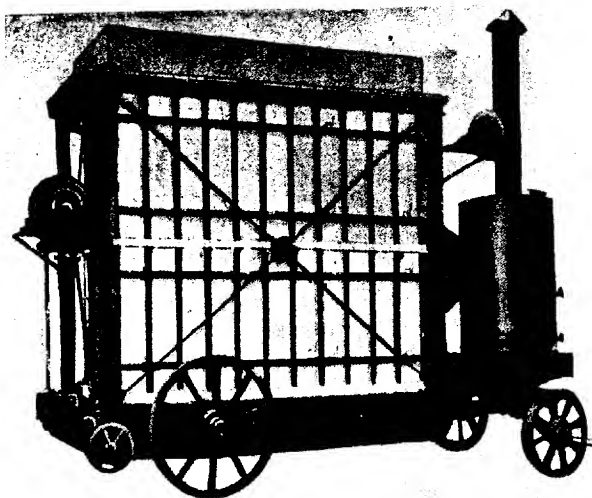


Fig. 1. — Side view of paddy esiccator.

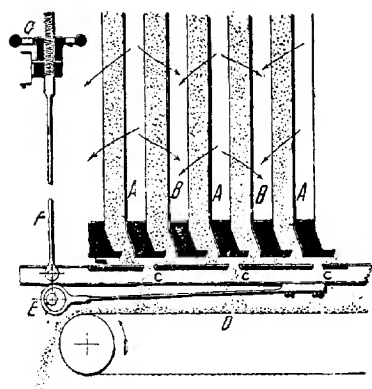


Fig. 2. — Partial longitudinal vertical section of paddy esiccator.

At Kienberg a two-engine Ergomobil plough and a rotary digger have good results.

At Etzin a two-engine benzine motor outfit has proved very suitable for soft moor soil. The 24 HP motors ploughed 0.62 acre per work-hour. On dry hard soil, however, the motors are not powerful enough; they should be at least 30 HP.

At Hartenholm the motor plough has been successful on waste land that had been once broken up, but it is not yet known how it would behave on the rough virgin moor.

On the whole the reports show that the efforts for the construction of motor ploughs suitable for moors have yielded good results.

- **A New Esiccator for Paddy.** — TARCHETTI I., A., in *Il Giornale di Riscicoltura*, Year IV, No. 6, pp. 88-90, Vercelli, March 30, 1914.

A new type of portable paddy esiccator has been designed and built by Geminardi, Guidetti & Co., mechanical engineers, of Vercelli, Italy. A side view of the machine, which is simple and strong, is shown in fig. 1, and a part of its longitudinal section in fig. 2.

The paddy is fed from the top into a series of vertical parallel chambers of 2 1/2 inches wide and separated from each other by air spaces, A, B, of the same width. The hot air from the generator first enters into the spaces A; as these are closed at the top it is forced to pass through the rice in the spaces B, whence it escapes into the atmosphere. The temperature of the air is regulated by suitable slides in the hot air generator and the fan.

The dried paddy issues through a slot in the bottom of the vertical chambers and falls onto the horizontal plane, CCC, which moves forwards and backwards by means of an eccentric and connecting rod, and thence onto a canvas carrier which delivers it at one extremity of the machine.

The amount of rice passed through the esiccator is regulated by changing the speed of the eccentric and by raising or lowering the plane C by means of the screws in G.

The vertical chambers in which the rice is dried are formed by light frames on which wire netting is stretched and which slide easily into grooves in the framework of the esiccator.

The machine can hold about 112 cwt. of paddy.

- **Artificial Hay-Drying.** — *The Country Gentleman*, Vol. LXXIX, No. 22, p. 1033. Philadelphia, May 30, 1914.

In many countries a great deal of hay is more or less spoiled or even completely lost every year by the heavy dews and rains of the haying season.

Several years ago T. P. Russell, a Southern Missouri farmer, wrote the United States Department of Agriculture to ask whether the artificial curing of hay was not an economic possibility. The office of Farm Management began to investigate the question at his farm from 1907 to 1913 and now the problem has been solved.

Hay can be cured at a profit, be it green, half cured or soaked with rain or dew. Freshly cut grass covered with dew or rain and containing 70 to 80 per cent. of moisture can be cured in 20 to 40 minutes into hay containing 10 per cent. of moisture and this hay can be baled immediately on leaving the kiln and will keep indefinitely.

The above-mentioned office has erected an experimental plant for curing of hay; it is practically a barn heated by a steam boiler. At one end the barn is a feeder chute into which the green or wet hay is fed as it comes from the fields. As it enters the chute it is caught on slowly moving belts which carry it round and round the heated interior of the barn, finally bringing it out at the other end cured and ready for baling or for storing.

The existing plant is worked at a steam gauge pressure of 80 or 90 lb. which gives a maximum temperature of 260° F. (126 °C.) at the bottom of the drier, and 223° F. (106 °C.) at the top.

The hay it turns out is superior in colour to field-cured hay and has a very sweet aroma, and in repeated tests the animals before which both kinds of hay were placed ate the former first and often refused the latter.

Analysis shows that the drier-cured hay differs little from the uncured grass and is superior to field-cured hay. The protein content, on a wet free basis, is 19.15 for uncured grass, 18.70 for drier-cured hay and 17.50 for field-cured hay. This difference is partly due to larger leaf content.

Mr. McClure, the official of the Farm Management Office, gives the following estimate for a hay-drying plant capable of turning out 1½ tons or more cured hay per hour:

Excavation	\$ 104.00
Kiln super-structure, walls, roof, settings for conveyors, etc.	\$ 2 166.62
Doors, hinges, guide plates	\$ 233.75
Engine shed	\$ 300.00
Painting and glazing	\$ 281.25
Conveyors, drive, fans, turbine, elevator, regulator, castings boiler and other machinery	\$ 10 422.08
Contingencies	\$ 2 500.00
Total	\$ 16 001.65

Of course no farmer of ordinary means can afford to invest such a sum, but large owners and cooperative associations could easily do so.

As for the cost of artificially curing hay, at the experimental plant in S. Missouri it was found that a ton of cured hay required 1.3 tons of coal. According to other experiments, however, it is asserted that in a 1500-ton drier the fuel requirements would be reduced to 0.6 ton of coal to one of cured hay. The total cost is given in table I.

Considering the advantage of assuring the regular output of hay regardless of weather, and the increased nutritive value of the hay produced by artificial means, it is safe to say that though artificial curing does not take the place of sun or field drying where and when good haying weather prevails, it will enable the grower so to cure his entire crop that it will all grade as "choice" and thus command the highest prices.

TABLE I. — *Cost of artificial hay drying.*

	When a ton of coal costs		
	2.50	3.50	4.50
Cost based on 0.6 ton of coal per ton of cured hay \$	1.50	2.10	2.70
Labour, interest, maintenance, etc. \$	2.97	2.97	2.97
Cost of curing from standing grass to baled hay \$	4.47	5.07	5.67
Cost of curing one ton in field \$	2.60	2.60	2.60
\$	1.87	2.47	3.07

Besides the above investigations, the Office of Farm Management examined the possibilities of a plant operated by direct heat. The consists of a sheet-iron box, 6 by 3 by 3 feet, equipped with a sliding containing damper and thermometer connecting this firebox to the back of an ordinary steam boiler. It was fitted with woven wire trays holding hay and a fan.

With this equipment the drier could be operated up to 700° F. (370° C.), with an air circulation through the drier up to 4 500 feet a minute. Table II gives the results of experiments with this direct heat drier.

TABLE II.

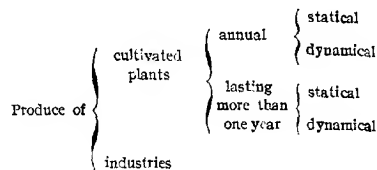
Velocity in discharge	Temperature		Time required to cure	Protein per cent.
	Front (1)	Rear (1)		
L	deg. F.	deg. F.	minutes	per cent.
500	600	250	8	18.81
200	640	260	5	17.62
300	450	220	15	17.50
650	400	200	15	19.50
800	400	250	15	18.69
800	350	225	20	17.61
200	600	415	15	24.69
800	320	200	10	19.75
400	320	215	20	20.38
15 min at ordinary temperature (2)				21.31

Front " where the hot air first comes into contact with the hay ; " Rear " where the air has passed through the hay and is ready to be discharged from the drier by the fan.
This sample was carefully cured without the loss of any leaves and therefore does not truly represent ordinary field-cured hay.

RURAL ECONOMICS.

845 - **Statistical Research on Farm Produce.** — MARENGHI, ERNESTO. Extract from the "Giornale degli Economisti e Rivista di Statistica", Part I, pp. 1-31 + 21 — Athenaeum, Rome, 1914.

As an introduction to his research, the writer draws up the following scheme of farm produce:



I. — THE PRODUCE OF CULTIVATED PLANTS.

A: The group of statical annual produce. — To this belongs the produce of herbaceous crops, as well as that of woody plants submitted to regular cultivation, that is subdivided into as many groups of the same age as there are years in the whole cycle of production.

This produce is *statical* on condition that the systems of cropping do not vary. The relative succession of these products may acquire increasing *dynamical* character only if the systems of cropping improve or deteriorate, or if new enemies or modifications of physical environment appear; apart from these factors, the annual range of these products represented by a Cartesian diagram gives rise to a broken line, the general trend of which is parallel to the axis of the abscissae. The phenomenon of production of these crops belongs therefore to the group of those which are expressible quantitatively with sufficient approximation by the arithmetical mean of a sufficient number of cases. In practice it is suggested to extend the same observation to a period of 10 to 12 years, which is justified also by theory. The writer, however, observes that in periods of very rapid intensification of agricultural production it is well to restrict oneself to the comparison of a still more limited number of terms, because to every successive stage of progress for a given crop a different *normal production* corresponds. The idea of normal production is nothing absolute in itself, as it can be referred to sharply defined conditions of cropping, case by case.

B: Group of yearly dynamical produce. — To this belongs the produce of ordinary woody plants not subjected to yearly management. This produce varies from time to time, not only through accidental causes, but also as a function of the age of the plantations, which give rise to very characteristic dynamical chronological series which serve for the construction of the law of production concerned. The *normal production* of woody plants varies from case to case as a function of many factors: species of trees, system of management etc. One of

fundamental aims of economic statistics is that of investigating these by suitably applied methodical observation.

With this object the writer proposes to replace *observations in time* which require long periods of time, by *observations in space*, by recording the yields of woody plants in similar regions, separately for the plants of each age.

When this observation has been continued for a certain number of years, for instance 10 or 12, there will be sufficient material to determine the normal curve of production, assuming as the normal produce of the n^{th} year of age the average of the produce ascertained on trees of that age during the various years of observation. The series of the normal yields thus obtained is the numerical expression of the normal curve which is sought.

The writer notes that by the same process, in the short space of one year the data sufficient to draw a *gross curve of coexistent yield* may be collected, and that this may lead to the normal curve when the ratio between actual unit yield of the year under observation and the average of the years under investigation is known. Thus, representing the equation of the gross curve by

$$y = f(x)$$

the normal one will be :

$$y = K f(x),$$

in which K is the ratio defined above. The writer obtains similar results on the hypothesis that the methods of management do not vary sensibly) from the data of a *gross series of successive yields*, the perfecting of which may be obtained by arithmetical, algebraical or graphical means. The simplest of all: it consists in substituting for every term of the series the arithmetical means of the three, five, seven, etc., terms of which it is the middle one (Wittstein's method). The *algebraical* process consists essentially in replacing the gross curve by a simpler one which it is assumed corresponds to the real law of the phenomena. The problem is solved by causing a curve of a certain order to pass through certain points under determined conditions according to the method of interpolations. The *geometrical* or *graphical* method consists in representing the gross series by a Cartesian diagram and in interpolating in it a curve which approaches the same series and then determining according to scale the values of the ordinates corresponding to the theoretical curve.

The writer then discusses the fragmentary series and the process of interpolation based on the hypothesis, which corresponds with sufficient approximation to reality, that the yield of woody plants varies approximately according to geometric progression provided the intervals considered be not too long and the accidental oscillations be neglected.

This process of interpolation finds its analytical expression in the following formula, which allows the missing data of the series to be interpolated :

$$y = K \alpha p^x.$$

in which :

y = average yield of the plant at the age of $\alpha + x$

$K\alpha$ = average yield of the plant at the age of α .

ρ = constant ratio of variation

x = independent variable quantity which gives the age of the plant in any year of the interval considered, supposed to be of n years

It follows that setting $K\sim$ for yield at the end of the same, the equation

$$K\alpha\rho^{n-\alpha} = K\sim$$

is obtained, from which the following results :

$$\rho = \sqrt[n-\alpha]{\frac{K\sim}{K\alpha}}$$

This process of interpolation thus consists in the analytical representation of the production of woody plants bearing annual produce, not by means of a single curve (in which case the approximation would be too wide but with several and successive branches of curves connected with each other). These may be considered as the expression of as many empirical laws of the phenomenon that is investigated, each of them being, with sufficient approximation, with certain limits of age of the same plants.

The exactness and the value of the process of interpolation may be experimentally checked when suitable statistical data are available.

The writer notes in this connection the low trustworthiness of the statistical data existing as to the curves of production of woody plants bearing yearly produce, and the necessity of systematic observations of the same in order to collect valuable material for the solution of the most varied economic problems.

C: The group of polyannual produce. — To this belongs the principal production of woods not under regular rotation. These woods are either high forest, in which case the cycle of the formation of the product coincides with that of the plant, or they are coppice, and then it is a submultiple of the latter. The distinction is of a certain importance for these statistical researches, since high forest gives rise to a *chronological series of statistical produce*, whilst coppices — at least in some cases — gives rise to *dynamical series*.

The data that are necessary and sufficient to individualise the fundamental production of woods are two: the *physical quantity* (discriminated if necessary in selected groups or otherwise) and the *extent of the corresponding cycles of elaboration*, which are not fixed as they are for the annual products, but are susceptible of being varied within certain limits with the object of realizing a maximum profit, other conditions being equal. Thus the curve of the increment of wood in forest plants is characterized by the progressive decrease of the rate of increment; during this progressive diminution the limit of profitableness is reached when the rate of wood increment expressed in money coincides with the rate of interest.

D: *The indices of variability* of crops and the ways of determining them. Crop, other conditions being equal, presents less risk the steadier its productivity, which is expressed by suitable figures called *indices of variability*. One of the indices most frequently used for statistical series is obtained by dividing the square of the mean deviation of the mean of the fields during the various years of observation from the arithmetical mean of the whole period by this latter mean.

The writer notes that these indices of variability are not liable to generalization but are strictly connected to the special conditions of environment and proves by means of suitable examples that the range of the yield of the same crop varies within very wide limits from one locality to another as a function of many circumstances.

II. THE PRODUCTS OF AGRICULTURAL INDUSTRIES WHICH RESULT IN A MORE OR LESS ELABORATE TRANSFORMATION OF CROPS.

The ratio (at least approximately) between them is *constant* in some cases and *variable* in others. It is constant, for instance, in the transformation of grapes, olives etc., but variable in that of forage crops. The statistical investigations to be carried out in the first case are not many, it being enough to determine the coefficient of *yield per unit*. If this ratio is variable the *law of variation* has to be sought according to the systems of methodological statistics.

The writer restricts himself to a consideration of the production of milk and of meat.

The production of milk varies — for every individual kind of cow — according to many factors: breed, age, diet, stage of lactation, etc. In order to get the principal characters of the process, a sufficient number of animals have to be subjected to experiment and they have to be grouped according to age, diet, or other factor, in agreement with the problem to be solved. Supposing the factor considered be age, the average individual yield of the animals under observation will have to be determined for each class of age. The series of average yields obtained will give the curve of the facts as functions of the age; this can be further simplified by transforming the individual terms in index numbers, it is by making the first term equal to 100 or 1000 and reducing the others in proportion.

The writer reports some data collected on a group of Simmental cows and sees that the general trend of the curve of the annual individual mean yields shows a certain analogy to what is observed in the production of woody plants bearing fruit yearly.

The writer examines similarly the influence of the time that has elapsed from the beginning of the lactation on the yield of milk, and from the individual chronological series obtained from a Swiss cow belonging to the Lugano Agricultural Institute he finds the corresponding normal curve by means of a suitable process of equalizing. The production of milk in the months following calving diminishes very nearly in geometrical

proportion and consequently the normal curves may be represented analytically by functions of the type of:

$$y = p_1 \rho^{x-1}$$

in which

y = milk yield of any month x .

p_1 = milk yield of the first month after the birth of the calf.

ρ = a constant ratio to be determined either by the method of least squares or, simpler still and with sufficient approximation, by taking the average of the actual ratios which are obtained by dividing every y by the one which precedes it.

In a special table the writer compares the actual series of a group of Swiss cows with the theoretical series and notes that the agreement between the two is more than satisfactory. Even on the hypothesis that the actual series should present some gaps, the ratio ρ of variations could be determined (though less exactly) and the analytical formula could be used and it would among other things allow the whole series to be reconstructed and the total corresponding yearly production to be determined.

Submitting to a similar process some data relating to the production of flesh, the writer notes that the series of the increments of weight unit in young and in adult animals in course of being fattened gives rise to a descending curve which turns its convexity to the axis of abscissae which may be represented — as in the case of milk yield — by an equation of the type of:

$$y = p \rho^x$$

The development of animals by weight follows the economic law of increasing production. A gradually diminishing increment by weight corresponds to an increasing consumption of fodder. Admitting as a fairly probable hypothesis that the rations of animals are homogeneous for each group and directly proportional to their weight, the writer infers that the above equation represents also the action of the said law as regards the production of flesh.

846 - **The Position of Non-Breeding Dairy Farms in Modern Agriculture.**
BRINKMANN, THEODOR, in *Fühlings Landwirtschaftliche Zeitung*, Year 67, Part
pp. 433-440. Stuttgart, July 1, 1914.

The subject of dairy farms which do not breed their cows, especially in their importance from the point of view of social economy, is not discussed at present. The writer studies the problem exclusively from the point of view of rural economy and proposes to answer the two following questions:

1. Is it justifiable from the economic point of view to keep dairy cows without breeding them, and if so under what general conditions is this to be preferred to dairy farming with breeding?

2. What are the effects of the present changes in the conditions of the industry and of agricultural production upon the profitability of

ival systems? Do they affect both systems equally or do they one more than the other?

— Both systems are intended to utilize to the utmost the fodder on the farm itself, and this especially by transforming it into milk. A non-breeding dairy farm can, with the same quantity of fodder, produce larger quantities of milk than the breeding dairy farm, because the former keeps only milk-producing animals; further it possesses another advantage from the point of view of the utilization of milk in that while on a breeding farm a part of the milk produced is consumed by the calves, on a non-breeding type can utilize at will all the milk that it produces and may regulate its production to suit the demands of the best possible market. These advantages ensure the non-breeding dairy farm gross returns in money which are fairly high in comparison to the quantity of milk to be utilized. This, however, cannot be obtained without a relatively high cost of production, caused especially by the loss, which in general is considerable, entailed by the purchase and sale of cows, by the necessarily intensive feeding and great consumption of concentrated foods, by the relatively high price of labour and by the considerable risk attendant upon the continual purchase of strange cows.

From these considerations it is evident that the conditions which justify the existence of non-breeding dairy farms are present when it is possible to utilize the large quantities of milk produced in the farm in such a way that the receipts balance the high cost of production. If the price of the milk increases gradually, a point must be reached at which the advantages resulting from the high gross yield are superior to the disadvantages caused by the high cost of production. This is clearly shown by Table I (1), in which the yield in milk and the gross returns in cash for the different prices of milk have been calculated, then the cost of keeping the cattle, that of concentrated foods and lastly the difference between gross returns and outlay, that is the net returns obtained by utilizing the fodder at different prices of milk, referring all the figures to 100 kilos (220 lbs.) of the average value of the fodder produced in the farm itself. These calculations have been made for three different groups of farms: 1) dairy farms which do not breed their cows; 2) dairy farms which breed a part of their stock; 3) dairy farms which breed all their stock.

The division of labour which exists under these two systems of dairy farming is thus perfectly justified as an economic necessity, as a consequence of the variations, from one farm to another, of the net returns resulting from the utilization of milk. After all the problem of the non-breeding dairy farm is only a question of the price of milk. Nevertheless no conclusion cannot be drawn that a limit of fixed profitability, true under all conditions, can be established between the two systems; on the contrary, the deciding limit in the price of milk must be determined separately in each case, as it depends upon the special conditions of each farm:

) This table is taken from FUNK: Die landwirtschaftlichen Betriebsverhältnisse der kleinen Milchwirtschaften im Havelland. — *Arbeiten der D. L. G.*, Part 169.

TABLE I. — 100 kg. (220 lbs.) of starch value

	Number of farms	Gallons	I. Supply							
			Gross receipts in cash when the price of per gallon is:							
			d 6.44		d 7.48		d 8.56		d 9.60	
			s	d	s	d	s	d	s	d
In dairy farms which do not breed	23	50.25	26	9 ³ / ₄	31	3 ¹ / ₄	35	9	40	2 ³ / ₄
In mixed dairy farms . . .	21	45.50	24	4	28	4 ³ / ₄	32	5 ¹ / ₂	36	6
In breeding dairy farms. . .	13	34.75	19	2	22	4 ³ / ₄	25	6 ³ / ₄	28	9

its size, the quality and quantity of the fodder to be utilized, the requirements as to the production of farmyard manure, the professional capacity of the farmer and the amount of his capital. In general it may be said that the conditions to warrant the division between the two systems exist only where the milk is sold as such.

II. — It is evident that in the course of time the limits of the areas occupied by each system shift in consequence of the changes which occur in the conditions of profitability. The expenses due to certain factors of production, chiefly those which weigh heavily on farms that do not breed, have increased considerably of late years. This is especially the case with concentrated foods and the losses caused by restocking the stable and with the price of labour.

On comparing the average prices of the two periods 1901-03 and 1909-11, an increase of 14 per cent. is found in the price of earthenware, 12 per cent. in cotton seed, 17 per cent. in coconut cake, 18 per cent. in wheat bran and 23 per cent. in brewer's grains. The increase in the price of labour and the decrease in the quality of the work done are notorious. The increase of the cost of concentrated foods and of other expenses weighs also on the budget of breeders, but not so heavily as on the non-breeding dairies which spend almost twice as much as the former on concentrated food (see Table). Furthermore there has been, since 1900, a rapid rise in the price of milch-cows, amounting to £ 5 to £ 6 per head in the Rhine Province. Though the increase in the price of milch-cows has been partly balanced by the increase in the prices of fat cattle, this rise in the price of cattle weakens considerably the position of non-breeding dairies, for in the competition between the two systems the increase in prices injures the one and benefits the other, since the high prices paid by the non-breeding dairies are an advantage to the breeders.

It is undeniable that of late years there has been a considerable increase in the sale price of milk, but according to the writer the consequent increase of the gross returns has not been sufficient to counterbalance the

produced on the farm (hay, straw, mangolds, etc.)

II. Require the following expenses							III. Yield a net profit when the price of milk per gallon is:									
cur, st, ment ing al, alkon ck er gal.	for purchase of concentrated foods			Total			d 6.44		d 7.48		d 8.56		d 9.60		d 10.72	
	s	d	per gal.	s	d	per gal.	s	d	s	d	s	d	s	d	s	d
	d		d			d										
1.96	13	7 1/2	3.28	21	10 3/4	5.24	4	11	9	4 1/2	13	8 1/4	18	4	22	9 1/2
1.92	10	6 1/2	2.80	17	10	4.72	6	6	10	6 3/4	14	7 1/2	18	8	22	8 3/4
2.16	5	3 1/4	1.76	11	8	3.92	7	6	10	8 3/4	13	9 3/4	17	1	20	3 1/2

eased cost of production. And if such were really the case the consideration of increased chances of profit in breeding caused of late by the conditions of the market would always signify a sensible loss for non-breeding dairy farms. The fact is that during the last ten years the profits of cattle breeding farms have considerably increased, both absolutely and also relatively those of non-breeding dairy farms; it is this latter fact which settles the matter, because the question of the profitability of a branch or a system of farming does not depend upon this branch or system paying its expenses absolutely, but rather upon its bringing in more profit than any other branch which might replace it.

The weakening of the position of non-breeding dairy farms will be better understood when it is considered that the technique and the movement in the means of communication and other factors tend to say more to abolish the monopoly in the supply of fresh milk which formerly belonged to the districts of production nearest to the markets. Many and various circumstances concur in rendering easier the supply of milk to the centres of consumption, such as the facilitations offered by the new ways for the carriage of milk, the better preservation of fresh milk due to systematic treatment, the ease with which milk can be obtained from distant districts thanks to a series of organizations of producers, traders and sometimes of consumers; all these factors and others also act in the same sense, favouring the offer of milk and opposing the increase of its price, increasing the utilization price in new districts of production and centralizing the production of fresh milk. The creation of new districts of supply tends to equalize the local prices of milk and the intensity of production in the districts of supply. Those that are situated at greater distances may adopt a more intensive system; all of them, however, approach the average line in their degree of intensity. Thus, the farms which are intermediate between the non-breeding ones and those which breed their stock are especially favoured by recent developments and will increase in importance.

847 - The Organization of Team Work according to the Results of Bookkeeping and to Net Returns. — OSTERMAYER, ADOLF, in *Mitteilungen der landwirtschaftlichen Lehrkanzeln der k. k. Hochschule für Bodenkultur in Wien*, Vol. II, Part 3, pp. 411-423 Vienna, 1914.

The expense for the work done by draught animals is a large item in the total working expenses of a farm. Calculated on the results of bookkeeping they have been found to be as follows, when expressed as percentages of the total cost of production.

For cereals. . . .	{	in the plains. . .	11.0 %
		in the mountains. .	17.2 "
For beets. . . .	{	in the plains. . .	24.9 "
		in the mountains. .	28.2 "
For potatoes. . . .	{	in the plains. . .	19.9 "
		in the mountains. .	18.3 "
For hay. . . .	{	in the plains. . .	13.5 "
		in the mountains. .	11.4 "

The range of the amount of these expenses exerts a great influence upon the net returns of the whole farm, as the writer proves with the aid of the books of 61 Moravian peasant farms. The average net return of these 61 farms is 19s 11 1/2d per acre and corresponds to a rate of interest of 3.5 per cent. on the average capital of £28 4s 0 1/2d per acre. This result has been obtained at the average cost of 2s 11d per day's work per animal and an average number of 4.66 days per acre, which brings the expenses of team work to 13s 8d per acre. With the help of these figures the writer calculates the net returns which correspond to the range in the cost of the day's work of the animals from 2s 1d to 3s 11 1/2d.

s d		£ s d	
When the work day costs	2 1	the net returns are	1 3 8 1/2 per acre
"	" 2 6 1/2	"	" 1 1 8 "
"	" 2 9 1/2	"	" 1 0 5 "
"	" 3 2 1/2	"	" 18 6 "
"	" 3 5	"	" 17 7 "
"	" 3 10	"	" 15 9 "
"	" 3 11 1/2	"	" 15 2 "

Among the components of the cost of the work of draught animals the cost of feed and wages exert a decisive influence, as may be seen in Table I, in which the total cost of the day's work of an animal has been divided into its component parts for three groups of farms, each of them presenting different amounts for the keep of their draught animals.

TABLE I. — *Composition of day's work of teams.*

P	Average cost of a day's work		Daily outlay								Partial items in percentage of total outlay				Actual number of work days out of 100 available days
			Fodder	Labour	Amortizement and interest	Sundries	Total	Fodder	Labour	Amortizement and interest	Sundries				
s	d	s	d	s	d	s	d	s	d	%	%	%	%		
2	3½	9	—	6	—	¼	—	1½	1	4¾	53.6	34.6	2.4	9.4	60.9
2	8	—	10½	2	—	1	—	1	1	2½	70.7	14.1	6.9	8.3	45.8
3	8	—	11½	5½	—	1	—	1	1	7	58.9	28.6	5.8	6.7	43.1
2	11	—	10½	4½	—	1	—	1½	1	5½	60.8	26.1	5.1	8.0	46.5

Table I shows also that the cost of an animal's day's work does not follow the cost of keep, because it depends also to a great extent on the degree of effective utilization of the draught animals. Consequently this utilization has a great influence on the net returns, as may be seen in Table II, which shows the average net returns of several groups of farms arranged according to the degree of effective utilization of their teams.

TABLE II. — *Average net returns of groups of farms arranged according to the degree of effective utilization of their draught animals.*

Group	Small farms			Medium farms			Large farms					
	Degree of effective utilization	Net returns per acre			Degree of effective utilization	Net returns per acre			Degree of effective utilization	Net returns per acre		
		£	s	d		£	s	d		£	s	d
.....	98.3	1	15	4	72.5	2	10	7	62.2	1	14	0
.....	76.3		18	7	54.7	1	13	10	48.5	1	13	6
.....	51.9		9	10	36.8	1	4	1	41.5	1	8	0

The same results are obtained by grouping the farms according to net returns and calculating for the groups thus formed the average effective utilization of the draught animals, as in Table III.

TABLE III. — *Average utilization of draught animals by groups of farms arranged according to their net returns.*

Group	Small farms		Medium farms		Large farms	
	Net returns per acre	Degree of effective utilization	Net returns per acre	Degree of effective utilization	Net returns per acre	Degree of effective utilization
	£ s d	%	£ s d	%	£ s d	%
I	2 5 11	95.8	3 17 3	58.7	3 8 3	91
II	0 18 8	82.2	1 12 6	54.0	1 0 11	55
III	0 7 1	70.9	0 4 4	53.1	0 2 0	47

With one exception the net returns diminish with the degree of effective utilization, so that the most intense and regular utilization of available draught animals is a fundamental factor for obtaining satisfactory net returns.

Nevertheless in organising the work of draught animals there is another problem also to be solved, namely that of suiting the animals to the size of the farm, not only according to their number but also according to different kinds of draught animals. As such, horses, oxen and cows must be considered, and they differ from each other by their individual characteristics, pace, intelligence, facility of being driven, etc., and by the cost of their maintenance. The writer calculates the influence of the size of the farm, of its situation, of the intensity of farming, of the intensity of hoed crops and the means of communication, on the conditions of the work of draught animals in the 61 Moravian peasant farms, and illustrates the means of diagrams the employment and the degree of utilization of different kinds of draught animals in the farms, divided into two groups according to the amount of the net returns. The results of these calculations are set forth in Table IV.

In small farms the great use of the cow as a draught animal is very advantageous; a too liberal use of horses and oxen causes a decrease in the net returns; on the other hand in large farms the work of horses is very advisable and it should be completed by that of oxen only to a limited extent, because large farms require team work more continuous than small farms and horses are more suitable than cattle, and especially cows, to continued work.

In well organized mountain farms the work of horses is much employed to a lesser degree that of oxen, while cows are only used as a temporary reserve during the busiest time in the summer. The increase of the number of oxen and the simultaneous reduction in the number of horses causes a decrease of net returns. Similarly in the plains the best utilization of the draught animals is obtained only by the supplementary use of the labour of oxen, though the number of horses is by far superior to that of the oxen. The organization of the team work in intensive farms with high net returns resembles very closely that of well managed plain farms.

	Small farms, less than 24.7 acres	Large farms, over 24.7 acres	Plain	Mountain	live			Hired crops		live		distance from market		Rounded property and fields near farm	Scattered property and fields far from farm
					over	under	per acre	over	under	12 %	12 %	under 3-11 miles	over 4-66 miles		
High net returns	Horse days	545	4 760	5 439	2 640	5 545	1 401	5 174	2 106	1 793	5 093	4 061	4 652		
	{ available														
	{ used	401	2 477	2 997	1 679	3 160	946	2 791	1 339	1 179	2 966	2 314	2 977		
	Ox days	0	533	800	274	640	1 372	457	593	946	355	0	0		
	{ available (1)														
	{ used	0	158	238	103	190	414	136	224	355	165	0	0		
Low net returns	Cow days	2 130	0	0	637	152	856	108	976	961	84	249	0		
	{ available (1)														
	{ used (1)	2 130	0	0	637	152	856	108	976	961	84	249	0		
	Horse days	1 772	3 581	5 605	2 558	4 751	3 356	3 546	3 191	2 506	2 517	1 579	2 928		
	{ available														
	{ used	742	1 724	2 975	1 164	1 985	1 472	1 360	1 143	1 596	1 332	799	1 240		
Low net returns	Ox days	1 797	0	0	1 409	531	1 175	442	2 097	0	1 839	1 908	243		
	{ available														
	{ used	854	0	0	661	359	545	299	997	0	883	785	83		
	Cow days	1 859	2	0	782	886	0	1 364	909	750	492	922	640		
	{ available (1)														
	{ used (1)	1 859	2	0	782	886	0	1 364	909	750	492	922	640		

(1) As the cows' keep is not to be debited to the labour account except when the cows actually work, the available cow days have been put equal in number to those effectively utilized.

because the good climatic conditions and the fertile plain land lead to intensification of farming. It is a mistake to make much use of oxen as draught animals in intensive farms and it reduces the net returns. Near the same results are obtained by grouping the farms according to the intensity of the hoed crops.

It follows that the horse may be considered as the draught animal *par excellence* for intensive farms. On the other hand well managed farms under extensive cultivation show a remarkably small use of the horse and a notable preference for the work of cattle, both oxen and cows and it is especially in farms with not much land under hoed crops that the work of cows is prevalent. Errors of organization in this case are the prevailing use of horses, which are insufficiently utilized, and the neglect of cows, which are the most suitable draught animals for extensive farming.

Farms near the markets can utilize cattle to a greater extent than those situated further off, notwithstanding the constant tendency towards the intensification of culture, and without diminishing their net returns they are even forced to do so in order to utilize regularly their draught animals. Indeed the necessity of a good deal of carriage is a factor of the equal distribution of animal labour, inasmuch as this transport work may generally be performed at the times in which work is slack on the farm. This explains the great amount of horse labour in farms at a distance from markets and yet yielding considerable incomes.

It is the same with the distance between the fields and between the fields and the farm. A very small distance or none at all favours the intensification of culture and leads to the prevalent work of horses, completely that of oxen and cows, with a view to equalizing the distribution of the work. The use of horses becomes still more prevalent in those farms in which the fields are wide apart and distant from the farm itself. The group of farms is the only one which still gives high returns while using oxen and horses as draught animals; this is explained by the time saved by the quick pace of the horses in covering the above distances. In these conditions the use of cows would be an error.

From what has been said it appears manifestly that in organizing the work of the animals of a farm the capability and the characters of the different draught animals employed are the basis on which they are to be chosen. It is only by combining and completing reciprocally the work of the various animals in harmony with local conditions that it can best be utilized with the object of keeping the cost of production low and of obtaining high net returns.

The writer demonstrates the truth of the above by means of diagrams containing for the previously mentioned 61 farms, divided into three groups according to the amounts of net returns, the curves of the horse, ox and cow days, per week and per 100 acres of area of cultivated land. These curves are compared with each other and with the line representing the annual average of the work days, expressed in horse-days per acre in the farms yielding high net returns.

Investigations into the Profitableness of Fen Cultivation. — FRECKMANN, W., and SABOTTA, in *Landwirtschaftliche Jahrbücher*, Vol. XLVI, Part 2, pp. 275-326. Berlin, 1914.

The writers endeavour to solve the problem of the profitableness of cultivation on the basis of the experience collected during ten years of work at the Neu Hammerstein Moor Experiment Station, with help of the data contained in the literature on the subject. In the first place they try to determine the capital that is necessary for such undertakings and then they discuss the ratio between the purchase price of bare fen and the capital required for improvements. They estimate the capital for buildings for all kinds of farming at the average figure of 10 per cent. of the total value of the land.

In the calculation of the profitableness of the regularly installed fen drainage, there is no question of ascertaining the amount of expense for each acre of the original acreage, but of determining the extent of utilisable area after the improvements have been carried out, as well as the cost of drainage and improvement of the unit of productive surface of fen in order to show the interest that it bears. Draining by means of open ditches involves a considerable loss of area. The writers calculate the amount of loss, and the capital represented by the Neu-Hammerstein fen farm, as follows:

Unsanded meadows.

<i>A) Drainage by open ditches:</i>		£	s	d
1. Preparatory work per acre		1	19	8
2. Drainage by open ditches		1	6	9
3. Work on the slopes and sowing			6	4
4. For the main drainage canal			3	2
5. For roads			1	11
Total per acre of original area . . .		£3	17	10

For one acre of cultivable surface the cost of cultivating is as follows:

1. Preparatory work, draining, main drain, and roads per acre of cultivable land, with a loss of 2.25 per cent. or	£3.17.0 0.9775	3	19	9
2. Ploughing (8 inches) including hoeing		1	11	9
3. Disk-harrowing			19	0
4. Manuring:				
a) 6.37 cwt. kainit, 4.78 cwt. basic slag, including haulage		1	1	1
b) Mixing, carting and spreading			2	4
5. Sowing:				
a) Rolling			1	2
b) 9 ½ lb. clover and grass seeds		1	7	11
c) Sowing				9
d) Rolling with light roller			1	2
Total . . .		£9	4	11
Purchase value £11 18s per acre of bare fen: cost of cultivable area	£11 18s 0.9775			
		12	3	6
Cost of buildings per acre			7	18
Total cost per acre of cultivable area . . .		£29	7	4

B) *Drainage by fascines:*

1. Preliminary work	1 19 8
2. Drainage by fascines	2 7 8
3. Main drainage canal	3 1
4. Roads	1 11
Total per acre	£4 12 5
5. Ploughing and hoeing	1 11 9
6. Disk-harrowing	19 0
7. Manures, carting and spreading	1 3 6
8. Sowing	1 11 1
Total . . .	£9 17 9
Purchase value	11 18 3
Buildings	7 18 9
Total . . .	£29 14 5

In this way the writers calculate the cost of purchase and improvement per unit of area of the meadows and arable land and come to the following results (Table I).

In preparing sanded fen cultivation it is generally much more advantageous to bring the sand from outside rather than to excavate it from the subsoil of the fen, because a layer of 5 inches taken from the subsoil would cause an average loss of area of 20 per cent.; the consequent increase of the cost of installation per acre of cultivable surface would equal the cost of getting the sand from a distance of 2 660 yards, so that up to that distance this means must be preferred. There is the further reason that the subsoil sand is often exceedingly fine and harmful.

An argument in favour of underground drainage is that it avoids the expense of surface. Unless special technical reasons, such as the depth and special nature of the fen, or the constitution of the subsoil, or the impossibility of obtaining pipes or fascines at reasonable prices and of conveying them to the fen (often lacking in roads), oblige the open drain to be resorted to, this form of drainage should be avoided.

Besides the financial reasons it must also be borne in mind that open drains in winter do not carry off a sufficient quantity of water, and further that the vegetation on the edges and slopes of the ditches affords protection to animals and plants injurious to crops.

In establishing the cost of producing the several crops the writers include in the general farm expenses: the interest on the instruments of production (live and dead stock and stores), all expenses for management and supervision, for bookkeeping taxes, dues, repairs of buildings and machinery, wear and tear of buildings and plant, etc. For the individual crops the following percentage of the gross yield is considered as general expenses: for meadows 12 per cent., for pastures 10 per cent., and for field crops 8 per cent.

In the calculation of the crop returns the writers use figures that are somewhat below the real average yields at Neu Hammerstein, as in Table

Description of system of cultivation	Value of improvement			Purchase price of land			Value of buildings			Capital (a + 3)			Total value (1 + 2 + 3)			Share of cost of improvement in % of total value			Ratio of purchase price of land to value of improvement		
	£	s	d	£	s	d	£	s	d	£	s	d	£	s	d	£	s	d	100 :		
Unsanded meadows, ditch drainage . . .	9	5	1	12	3	6	7	18	9	20	2	3	29	7	4	31.52			100 :	76.02	
Unsanded meadows, fascine drainage . . .	9	17	9	11	18	0	7	18	9	19	6	9	29	14	6	33.27			100 :	83.10	
Unsanded meadows, pipe drainage . . .	16	16	9	7	18	9	7	18	9	15	17	6	32	14	1	51.47			100 :	212.18	
Sanded meadows, pipe drainage . . .	22	7	9	7	18	9	7	18	9	15	17	6	38	5	2	58.52			100 :	282.16	
Sanded arable land, ditch drainage . . .	29	9	1	9	0	4	7	18	9	16	19	1	46	8	2	63.47			100 :	326.64	
Sanded arable land, pipe drainage . . .	27	11	1	7	18	9	7	18	9	15	17	6	43	8	6	63.45			100 :	347.25	
Unsanded arable land, ditch drainage . . .	10	19	4	8	14	5	7	18	9	16	13	2	27	12	6	39.70			100 :	125.76	
Unsanded arable land, pipe drainage . . .	9	1	9	7	18	9	7	18	9	15	17	6	24	19	3	36.42			100 :	114.57	

TABLE II. — *Yields of arable crops (lbs. per acre).*

	Sanded land				Unsanded land
	Actual averages		Figures used in calculations		
	Grain	Straw	Grain	Straw	
Winter wheat.	3 200	6 900	2 850	4 100	1 750
Rye.	3 000	5 200	2 300	5 200	2 600
Oats.	3 350	4 100	2 500	3 750	Spring rye
Barley.	2 600	3 350	1 950	3 000	—
Horse beans.	3 050	7 500	2 300	3 500	1 875
Potatoes.	28 850	—	17 800	—	16 000
Mangolds.	60 250	—	53 500	—	53 500
Carrots.	43 200	—	44 500	—	—
Mixed grain and pulse.	—	—	—	—	1 875
Rape and colza.	—	—	—	—	1 425

On account of the high risk in fen farming of damage from frost pests, deductions are made in the crop accounts, as shown in Table

TABLE III. — *Deductions for risk (% of gross yield).*

	Sanded crops		Unsanded crops
	Open drains	Pipe drains	Open drains
Winter rye.	8	6	20
Spring rye.	—	—	15
Oats.	10	8	—
Wheat.	20	16	—
Barley.	24	20	—
Beans.	12	10	20
Potatoes.	10	10	15
Carrots.	12	12	—
Mangolds.	12	12	20
Pulse.	—	—	22
Rape.	—	—	30

On the above mentioned lines the accounts are kept and their results are collected in Table IV.

Crop	1 Total cost of farming	2 Value of actual gross returns	3 Returns after deduction of risk	4 Net returns (3-1)	5 Capital in land	6 Interest on capital in land at 4 %	7 Capital in improve- ments	8 Interest on capital in improvements		10 According to net returns capita- lized at %	11 Capital value £ s d per acre
								In £ s d (4-6)			
								In %			
								£ s d per acre			
1) Meadows with open ditches . . .	3 16 3	5 11 1	5 11 1	1 14 10 20	2 3	16 1	9 5 1	18 9	10.15	5	34 17 6
2) Meadows without sand . . .	3 0 2	5 19 9	5 19 2	2 19 8 15 17 6	12	9 16 16 9	2 6 11	13.95	6	49 14 3	
3) Sanded meadows . . .	2 17 1	6 14 1	6 14 1	3 17 0 15 17 6	12	9 22 7 9	3 4 4	14.36	6	64 3 5	
4) Sanded field crops . . .	5 2 2	10 3 1	9 6 10	4 4 9 16 19 0	13	6 29 9 1	3 11 2	12.08	6	68 11 2	
a. Rye . . .	5 4 2	10 3 1	9 11 11	4 7 3 15 17 6	12	9 27 11 1	3 17 7	14.10	—	—	—
b. Oats . . .	5 0 6	11 19 11	10 15 11	5 15 4 16 19 0	13	6 29 9 1	5 1 11	17.30	—	—	—
c. Wheat . . .	5 2 6	11 19 11	11 0 9	5 18 3 15 17 6	12	9 27 11 1	5 5 6	19.16	—	—	—
d. Barley . . .	5 9 6	15 15 9	12 12 7	7 3 1 16 19 0	13	6 29 9 1	6 9 6	21.99	—	—	—
e. Horse beans . . .	5 11 6	15 15 9	13 5 3	7 13 9 15 17 6	12	9 27 11 1	7 1 0	25.60	—	—	—
f. Mangolds (open ditches) . . .	5 1 3	9 9 6	7 11 5	2 2 9 10 19 0	13	6 29 9 1	1 9 2	4.95	—	—	—
g. Carrots (open ditches) . . .	5 3 3	9 9 6	7 11 5	2 2 9 10 19 0	12	9 27 11 1	1 15 7	6.46	—	—	—
h. Winter rye . . .	5 8 5	9 9 11	8 15 11	3 7 6 15 17 6	13	6 29 9 1	2 13 11	9.16	—	—	—
i. Potatoes (open ditches) . . .	5 10 5	9 11 8	19 11 3	9 6 15 17 6	12	9 27 11 1	2 16 10	10.32	—	—	—
j. Mangolds (open ditches) . . .	8 1 6	11 18 0	10 14 3	2 12 9 16 19 0	13	6 29 9 1	1 19 3	6.66	—	—	—
k. Carrots (open ditches) . . .	6 6 1	14 5 8	10 9 6	4 2 6 16 19 0	13	6 29 9 1	3 9 0	11.71	—	—	—
l. Unsanded field crops . . .	6 19 8	17 0 15	14 3 8	14 7 16 19 9	13	6 29 9 1	8 1 0	27.33	—	—	—
m. Winter rye . . .	5 0 8	0 3 6	8 3 1	3 16 13 1	13	3 10 19 4	0 11	4.51	5	21 18 7	
n. Horse beans . . .	5 8 5	8 2 11	6 10 3	1 11 16 13 1	13	3 10 19 4	8 7	3.94	—	—	—
o. Potatoes . . .	8 1 6	10 14 3	9 2 1	1 0 7 16 13 1	13	3 10 19 4	7 3	3.33	—	—	—

The results show that a fen farm when suitably drained and managed is profitable from the point of view of both private and public economy.

On the distribution of the area devoted to the different crops the general economic and market conditions have a great influence. Field crops always require a sufficient amount of labour for the suitable tilling of the fen soil.

The cultivation of unsanded fens is to be practised only when an excessive distance from the mineral soil does not allow the dressing to be applied at a reasonable cost.

Underground drainage by means of pipes or fascines is under circumstances to be preferred to open ditches for permanent pastures and field crops and this all the more the higher the purchase price of the bare soil.

For sanded fen soils, wheat, rye, oats, barley, potatoes, beets, grass, beans, rape and colza are to be considered as sure crops. Other pulses as well as serradella and mixtures of pulse and cereals (with the exception of lupins) are not to be quite neglected, but they are less advantageous. Sugar beets are to be grown according to the results of local trial in each individual case. Clover can only be considered in connection with grass leys.

For unsanded fen land the most suitable crops are rye, mixtures of wheat and pulse, beans, potatoes, and Swedes; next come rape and colza; oats and barley must be considered as doubtful. Wheat and beets in general to be avoided, and they can at most be considered on fens that have been warped.

The injury to fen crops by frost and pests must also be carefully examined with a view to finding the most suitable means of protection. There is, however, a certain compensation between the drawbacks of farming on fens, such as severe winter or spring frosts, various pests and the abundance of weeds, and the fact that fens are better ensured against the consequences of continued drought than the best deep higher soils.

In the droughty year 1911 the valuable loess soils gave miserable yields of hoed crops, clover and spring cereals, while the crops in the fens were not much inferior to the average. At Neu Hammerstein they yield as follows:

	Lbs. per acre	
Winter rye	3 200 grain	6 000 straw
Horse beans	2 750 "	7 300 "
Oats	3 900 "	5 600 "
Potatoes	40 900	
Mangolds	50 700	
Carrots	83 750	
Meadows	8 000	
Pastures	430 increase of live weight.	

The Cost of Establishing an Orchard. — EVANS, L. A. — *The Cultivation of the Apple in Tasmania*. Hobart, 1914.

The following are the data on the cost of establishing two apple orchards, one 25 acres in extent and the other 100.

Twenty-five acre orchard.

	£
Twenty-five acres at £20 per acre (ready for the plough)	500
Fencing, packing-shed and cottage	350
Five thousand trees at 70s per 100	175
Planting 25 acres	15
Five years' cultivation, pruning, etc., at £4.10s per acre	560
Interest on outlay for five years at 5 per cent. compound interest	370
Unforeseen expenses	30
Total	<u>£2000</u>

The returns from the fifth to the seventh year may fairly be calculated by the orchard expenses. From the tenth year onward the annual return from the orchard should be at least 6 000 bushels. These, at the average estimate of 2s 6d per bushel on the trees, give £750; deduct for working (calculating at £9 per acre), leaving £525, from which annual interest on £2000 has also to be deducted. Thus there would be clear income of £425. It must not be forgotten that a *bona fide* owner gives his own work and would thus save £80 a year; in addition he has £2000 capital he would get the interest on the amount invested, an average of £74 per year, giving him £154 to live upon until the orchard came into bearing; further that the price of 2s 6d per bushel on a tree is a moderate price and that by careful attention to packing and judgment in marketing higher prices can be realized.

The following estimate deals with a 100-acre orchard:

Estimate of cost of 100 acres of land cleared and planted with apples.

	£
First cost of 100 acres of land, at £5 per acre	500
Grubbing, etc., and clearing land to make it fit for ploughing, at £6 per acre	600
Cost of ploughing and subsoiling	100
Two-year-old apple trees at £3 per 100, planting 100 per acre	300
Cost of planting	100
Purchase of four farm horses	100
Implements and tools	300
Fencing with wire netting	80
Draining	100
Cost of buildings for manager, workmen, stables, etc.	780
Manuring young trees, artificials	450
Horse feed and cost of keeping horses for one year £100, labour and management £324 per year for five years	4620
Total cost of 100 acres of orchard at the end of five years containing 7-year-old trees	<u>£8000</u>

AGRICULTURAL INDUSTRIES.

850 - Refrigeration and Aeration of New Wines as a Means of Hastening their Maturity. — KLOSS, J., and SCHNEIDER, F., in *Allgemeine Weinzeitsung*, 31, No. 28, pp. 313-315. Vienna, July 9, 1914.

The writers carried out at the zymo-chemical laboratory of the College of vine and fruit growing at Klosterneuburg (Austria) several experiments on new white and red wines in order to study the effect of refrigeration followed by intense aeration on the maturing process. The wines in bottles and in casks, were kept during 24 to 48 hours at temperature 28.4 to 26.6° F. (at which temperatures they did not freeze), after which they were aerated (by passing air through them for 24 hours or rack them off and allowing them to fall in a shower through air) and then stored in a cool cellar for a fortnight. They were then filtered and examined. The wine used as control was not refrigerated, but otherwise it was treated in the same way.

The results were as follows: In red wines no effect of refrigeration could be determined. In white wines, on the contrary, the colour was darker than in the control wine and the taste and fragrance had decided more of the character of old and ripe wines. Chemical analysis showed a marked decrease in the content of nitrogenous matter; such a decrease is produced only by keeping wine a long time in cellarage and rack it repeatedly. The processes of oxidation, which cause certain constituents of wine (especially those containing nitrogen) to become insoluble and consequently to precipitate, take place much more rapidly in refrigerated wines.

Another benefit derived from refrigeration and aerating was seen in that the wines so treated and then filtered kept perfectly clear, whereas control wines very soon became turbid, which change is connected with nitrogenous matter still contained in the wine.

851 - Development and Present Situation of Milk Recording and Book-keeping Associations in Denmark. — Prepared from a communication from A. C. DESS, Adviser, Ruakobing, Denmark.

According to a communication from the Danish Statistical Bureau there were in 1909, 519 Record Associations in receipt of subventions from the State. Of this number 128 had been founded between 1895 and 1904, 207 between 1900 and 1904 and 184 between 1905 and 1909.

In 1909, 12 572 farmers possessing 224 837 cows were members of record associations, while 167 235 farmers with 1 047 316 did not belong to any association, and 2 566 farmers with 9 821 cows had not sent any answer to the enquiry.

The following figures for the year 1909 show the connection between the size of the farms, the number of animals and milk recording:

Size of farm	Percentage of farms in which milk records are carried out	Percentage of cows under record out of total of country
up to 1.36 acres	0.3	0.5
from 1.36 to 12.26 "	1.1	1.4
" 12.26 " 36.80 "	3.3	4.7
" 36.80 " 73.60 "	11.2	14.8
" 73.60 " 147.20 "	18.9	24.5
" 147.20 " 588.82 "	21.1	34.4
above 588.82 "	38.8	46.3
On the whole	7.2	18.0

It is thus evident that it is mostly the larger farms that submit their records to milk recording.

Many of the larger farms carry out milk recording by themselves and are not included in the above figures.

The number of milk recording associations has been almost stationary since 1909; this is due to the fact that the greater part of farmers interested in cattle breeding, in so far as conditions allow, belong already to associations.

In northern and western Jutland there are only a few record associations, as there fattening is prevalent. On the islands and in southern Jutland about a quarter of the number of cows are under record, in the north a third.

By the union of the associations into federations a certain uniformity of method is attained. Milk recording has already exerted some influence on breeding. At cattle shows only bulls which can show controlled performance records of their dams, grandams, etc., are exhibited. In a fairly high performances of the dams have been required as the conditions for admission to the shows.

The law of June 8, 1912, provides a yearly state subvention of £10 for these associations, each of which gets £11 on condition of conforming to certain regulations.

A record association has usually from 15 to 25 members with about 100 cows. The control work is carried out about every 20 days. The average cost per cow amounts to from 1s 5³/₄d to 1s 10¹/₂d per cow and about the State grant to 2s 2d; in these sums the board and lodging of the members to the control assistant are not reckoned.

Of late years the tendency is towards entrusting the control assistants only with the accounts immediately connected with the milk records also with the whole book-keeping of the farm. Thus the record associations gradually become book-keeping associations. The beginnings of these associations were fairly simple but not uniform. In the year 1909 such a book-keeping association was founded at Langeland and it has since been followed by others. The work of milk recording goes on in them usually, only as the book-keeping associations are smaller, the records

can be made oftener, which is all to the advantage of the greater trustworthiness of the results. The farm accounts at the same time supply a certain check on the performance records. The number of members is as a rule, from 15 to 18; they farm from 1200 to 2000 acres and own 20 to 300 head of cattle.

The cost of the book-keeping is reckoned on the basis of the acreage of the farm, while the cost of milk-recording is based on the number of head of cattle, as in the other record associations. A farm of 61 acres pays for its book-keeping from 22 to 33s a year. The farmers enter in specially prepared books and a cash book the several transactions according to the system of simple entry. When the record association assistant visits the farm, for the first time in every month, he posts the farmer's entries in the regular account books kept on the double entry system. This has the advantage that any error can be rectified at once *viva voce* and on the spot. According to the wish of each member the books are kept with a greater or lesser number of accounts. In general the farmers desire to know the returns of the various crops and the profitability of the different branches of their farms.

852—**Preserving Milk Samples for Examination.** — TILLMANN, F., SITTIGER, J. and RIFFART, H., in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel sowie der Gebrauchs-Gegenstände*, Vol. 27, Part 12, pp. 893-901. Münster i. W. June 15, 1914.

According to the writer's experiments the requirements of an ideal means of preservation are: 1) It must preserve the degree of acidity of the milk for at least 72 hours. 2) It must not bring about any change in the behaviour of the milk to alcohol. 3) It must cause no change in the physical and chemical composition of the milk. 4) It must not have an action on the nitrates which may be contained in the milk and especially a) it must preserve the nitric acid from decomposition, b) it must have no action on diphenylamine, neither weakening nor reinforcing its effect.

In view of these requirements the experiments made by the writers in their research for the most suitable substance, led to the discarding of a number of substances commonly used. They tried chloroform, thymol, oil of mustard, phenol, creosote, sodium fluoride, mercuric chloride and potassium bichromate. The latter substance reacts strongly on diphenylamine and should have been discarded, but it was tested owing to its current use.

The examination of the above-named substances led to the following results:

Thymol, phenol, creosote and sodium fluoride cause the milk to coagulate after 24 to 48 hours. Bichromate of potash, owing to the intense yellow colour it gives to milk, does not allow an accurate determination of the degree of acidity to be carried out. Chloroform causes an increase of refraction and of fat content. Creosote causes a decrease of specific gravity. Thymol and creosote enfeeble the diphenylamine reaction to a considerable extent. This is also the case in a small degree with oil of mustard and phenol. Bichromate of potash causes milk to give a strong

tive reaction with diphenylamine, even without the addition of a nitrate. All the means of preserving milk only chloride of mercury answers to above-mentioned requirements. When used in a 0.04 to 0.03 per cent. solution it preserves milk quite fresh for 120 hours without any noticeable increase of acidity.

Further it has no action whatever upon the milk constants and allows quantitative determination of nitrates to be carried out even after 24 hours. The use of chloride of mercury for official milk control is, however, owing to its poisonous nature, only admissible with certain precautions. Thus to allow it to be easily recognized the writers add a few drops of red to the sublimate. This colouring matter, used at the rate of 0.01 g. of a 2 per cent. solution in water in 250 cc. of milk, has no effect upon the results of the analysis of the latter.

PLANT DISEASES

GENERAL INFORMATION.

- 853 — Decree of the President of the French Republic, June 9, 1914, Authorizing the Introduction into France of Plants other than Vines through the Dijon Customs House. — *Journal officiel de la République française*, Year 44, No. 116, p. 5389. Paris, June 20, 1914.

Art. 1. — Trees, shrubs and all plants other than vines coming from foreign nurseries, gardens, hot-houses and orangeries may be introduced into France through the Dijon Customs House under the conditions set forth in articles 2 and 3 of the decree of August 28, 1882.

Nevertheless, the certificate of the competent authorities of the country of origin will not be required when the plants come from an establishment entered in the lists published according to article 9, paragraph 6, of the International Phylloxera Convention.

Art. 2. — The Ministers of Agriculture and of Finance are charged in their respective spheres, with the carrying out of the present decree.

- 854 — Order of the French Minister for the Colonies, June 19, 1914, forbidding the Importation of Hevea Plants into Indo-China. — *Journal officiel de la République française*, Year 46, No. 170, p. 5488. Paris, June 24, 1914.

Art. 1. — The importation into Indo-China of hevea plants is forbidden; the introduction into the Colony of hevea seeds is allowed and is not subject to any disinfection.

Art. 2. — The Governor-general of Indo-China is charged with the execution of the present order.

- 855 — Order of the French Minister for the Colonies, June 19, 1914, Establishing Regulations Concerning Disease in Coconut Plantations in Cochinchina and in the Annam and Cambodia Protectorates. — *Journal officiel de la République française*, Year 46, No. 171, pp. 5534-5535. Paris, June 25, 1914.

Art. 1. — A regulation concerning disease in coconut plantations has been established on the following bases in the Colony of Cochinchina and in the Annam and Cambodia Protectorates.

Art. 2. — Any person, owner, manager, farmer or holder in any of coconut plantations which have been attacked by the Coleoptera as elephant beetle or black beetle (*Oryctes rhinoceros* L.; in Annamese perfect insect is called "con kien vuong" and its larva "con sung") or by any other insect or in general by any disease of whatever kind, must immediately declare it to the nearest native or French authorities, who will without delay forward such declaration to the Chief Administrator of the Province, who, after having ordered a technical examination of the plantation, will order one of the following measures.

Art. 3. — If the trees are only slightly attacked by the elephant beetle, that is to say if only 5 or 6 holes bored by the insect have been detected, the owner or other person in charge must have the holes stopped with a composition containing pitch, coal-tar or similar compounds, and destroy throughout the property all the sources of infection as defined in Art. 5; he must also carry out such other measures as may be ordered by the authorities, in particular those which will be set forth in the special regulations published by the Administration.

Art. 4. — If the trees are either dead, badly attacked by the elephant beetle, or simply attacked by the weevil, they must be uprooted and either destroyed by fire or completely immersed in water so that the larvae, pupae or perfect insects be destroyed and that the debris not become a breeding place or a refuge for new parasites.

Art. 5. — Any person possessing lands at a distance of less than 1/4 mile from a coconut plantation (that is an area planted with 40 coconut palms per acre) is bound to destroy on the land belonging to him, the palms or other plants attacked by the elephant beetle or weevil, to remove or destroy the dead plants, trunks or debris of cocoons, and the heaps of manure or any other decomposing organic matter in which the presence of larvae of beetles has been detected or may become sources of infection.

Art. 6. — The Chief Administrators of the provinces and their assistants, the Agents of the Agricultural and Commercial and Forest Services, the officials appointed by the Government, are to have free access to coconut plantations, whatever their extent, in order to ensure the observance of the present Order. They can draw up reports which will be valid in default of proof to the contrary.

Art. 7. — Any person refusing or neglecting to comply with the regulations contained in the above articles 1, 2 and 3 is subject to the penalties set forth in articles 479 and 482 of the Penal Code.

Art. 8. — The same judgment inflicting the above penalties may, in the cases contemplated by articles 4 and 6, order the destruction of the sources of infection by the village and at the expense of the offender. If the offender is a European or a person considered as such, this destruction will be carried out in the same way but under the supervision of a police officer.

Art. 9. — The Governor-general of Indo-China is charged with execution of the present Order.

856 — Italian Royal Decree of May 3, 1914 (No. 425), Instituting an Independent Phytopathological Observatory at Turin. — *Gazzetta Ufficiale del Regno d'Italia*, Year 1914, No. 130, pp. 3056-3057 Rome, June 10, 1914.

Art. 1. — An independent Phytopathological Observatory is founded at Turin on the initiative of the Agricultural Association (Comizio Agrario) of Turin; the expenses are defrayed by the Commune, the Savings Bank of Turin; the Chamber of Commerce, the Charitable Foundation of St. Paul, the Grand Masters of the Orders of Saints Maurice and Lazarus and of the Crown of Italy, and the Agricultural Association, with assistance from the State.

Art. 2. — The objects of the observatory are : a) to follow carefully any condition of disease in cultivated plants and to study its causes and remedies ; b) to spread among farmers, by means of meetings, talks and practical lessons to be given in various localities, a precise knowledge of the diseases of plants and of the best means of controlling them ; c) to work with the cooperation of farmers, experiment fields for the protection of plants against the most widely spread diseases ; d) to watch over the parks, gardens and avenues of the city of Turin from the point of view of diseases and at the request of the Municipality, and if necessary to advise in the application of suitable means of control ; e) to examine doubtful mushrooms and other fungi at the request of the Bureau of Hygiene ; f) to give verbal or written consultations to the farmers of the district ; g) to attend to the institution of a special Museum of Plant Pathology ; h) to examine the seeds of cultivated plants as to purity and germinability ; i) to undertake the services of vigilance, warning, prevention and cure of the diseases of plants in Piedmont.

Art. 3. — The observatory is managed by a Board of Administration composed of representatives nominated one each by the Ministry of Agriculture, the Turin Savings Bank, the Turin Agricultural Association, the Municipality of Turin, the Chamber of Commerce and Industry of Turin, the Charitable Foundation of St. Paul, the Grand Master of the Order of St. Maurice, and those bodies or private persons who contribute annual subscriptions of not less than £ 20. The members of the Board hold their seats for three years and may be re-elected. The Board elects from among its members a president, also for three years and eligible for re-election. The director of the observatory is a member of the Board and acts as secretary.

Art. 4. — The Director is at the head of the scientific activity of the Institute ; he must present every year to the Board of Administration a report upon the work done in the course of the year, the programme of the experiments to be carried out in the following year, the estimate of the expenses and the balance sheet of the preceding year, audited by an accountant who is elected every three years by the Board and who must assist at the Board meetings as advisory member. Every year a copy

of these documents will be sent to the Ministry of Agriculture, Industry and Commerce.

Art. 5. — Besides the Director, the staff of the Observatory includes Assistant Director and a Curator-Secretary. The Assistant Director has the supervision of the Laboratory and, when necessary, replaces the Director. The Curator-Secretary is entrusted with the books, correspondence, library and collections, and if he has a degree he may substitute the Assistant-Director. If the budget allows, a second Assistant may be engaged according to the decision of the Board of Administration. The Assistant, after consulting the Director, may nominate one or two special volunteer or honorary unpaid Assistants, who will have the right to frequent the Observatory and to make use of the scientific material according to the rules laid down by the Director.

Art. 6. — The Director is nominated according to the results of a competition organized by the Board of Administration and his nomination must be approved by the Ministry of Agriculture. The rest of the staff is nominated by the Board of Administration on the proposal of the Director.

Art. 7. — The funds of the Observatory are provided as follows: State contributes £80 under chap. 66 of the Budget of the Ministry of Agriculture, Industry and Commerce for the year 1913-14, and in the corresponding chapters for the succeeding years; the Municipality of Turin £20; the Turin Savings Bank £80; the Chamber of Commerce of Turin £20; the Grand Master of the Order of Saint Maurice £20; the charitable Foundation of St. Paul £20; the Agricultural Association of Turin £20.

The Commune, besides its pecuniary assistance, provides housing, gas, stationery and plant other than scientific (furniture, etc.). The Ministry of Agriculture will also, in virtue of the Law of June 26, 1913 (388), which deals with measures for the prevention and cure of the diseases of plants (1), furnish special funds for the services of vigilance, inspection, prevention and treatment of diseases of plants in Piedmont.

Art. 8. — The advice given to farmers is free of charge. The Board of Administration may however establish a tariff for the reports and other documents demanded by the public.

Art. 9. — Other local institutions may give their adhesion to the Statute, lending their aid to the Observatory and securing representation on the Board by agreement with the founders and with the approval of the Ministry of Agriculture, Industry and Commerce.

Art. 10. — Special regulations proposed by the Board and approved by the Ministry of Agriculture will regulate the working of the Observatory.

Temporary provision.

Art. 11. — The present staff (Director and Assistant Director) of the District Observatory (2) will continue its work in the Independent pathological Observatory.

¹ See No. 995, B. Aug. 1913.

² See No. 278, B. Jan. 1911 and pp. 1000 1005, B. July 1913.

(Ed.)

BACTERIAL AND FUNGOID DISEASES.

857 - **The Conditions determining the Outbreak of Vine Mildew in Hungary**
 — Communicated by Dr. GY. VON ISTVANFFI, Professor at the University and Director of the Royal Hungarian Central Ampelological Institute, Budapest.

The Royal Hungarian Central Ampelological Institute of Budapest has now published (in Magyar) the fifth volume of its works; this contains the studies made by Dr. F. SÁVOLY under the direction of Dr. GY. ISTVANFFI. An abstract has also been published in French, as Vol. 5 of the *Annals* of the Institute; this was prepared on the occasion of the International Congress of Viticulture held at Lyons from July 20 to 22, 1913.

The most important results of Dr. SÁVOLY's work may be summarized as follows:

I. — The climatic conditions required by mildew cannot be determined except by carrying on researches for several years on an extensive and varied territory and by methodically working up the data thus obtained.

II. — Only study of the weather before the first appearance of mildew can lead to satisfactory results. It is sufficient to consider temperature and the quantity and frequency of the rain. As regards territory, the district ("járás") has been taken. The dates of the appearance of the disease were noted on a map and the parts in which they appeared simultaneously were joined up by lines. The curves so obtained are called "isophanes" and the areas enclosed between them "isophanic belts". Starting from the first appearance of mildew and proceeding to the relatively late appearances, we distinguish a series of isophanic belts, each member of which corresponds to a period 1.55 times as long as the preceding one.

III. — Comparing the data obtained from 1910 to 1912 the following observations can be made: 1) The earliest appearance of mildew in Hungary was on May 21. 2) In general most of the dates of appearance were between June 5 and 15, that is to say during the flowering period of the vines. 3) The date of the infection which causes this general outbreak of the disease must be sought in the last ten days of May.

IV. — The comparison of the mildew maps of the last four years gives the following results: 1) The first appearance of mildew occurs at the same locality every year, and its spread almost always follows the same main routes. 2) This characteristic constancy does not depend so much upon the weather as upon orographic causes and those connected with the nature of the soil. 3) In its spread mildew does not make jumps, but proceeds gradually from one locality to another; starting from the point at which it first appeared, numerous transition points are found towards the spots in which it appeared later. 4) The speed at which mildew spreads is not

(1) See also No. 68, *B.*, Jan. 1913; No. 1208, *B.*, Oct. 1913; and No. 529, *B.*, June 1914.

in all directions, but the speed in the several directions seems to be different every year.

V. — The features more or less common to these four years are visible on the map representing the appearance of mildew in its general features. It is seen also: 1) That in general mildew starts from a triangular area, the vertices of which lie near Kaposvár, Villány and Kecskemét. 2) That the disease advances for a certain time approximately in the directions marked by the angles of this triangle. 3) Independently of the first area, and one or two isophanes later, secondary centres of infection are observed, especially in the Kis-Alföld (Small Hungaria), then near Versec and on the sands of Hajdu and Szabolcs counties. The first-named is the most important, as it is the point of departure for an independent invasion.

VI. — Mildew generally makes its appearance in the following order: first in the country to the north of the Mecsek mountain, between Kecskemét and Lake Balaton, and in the valley of the Danube towards the south; a little later on the plain in the angle between the Danube and the Tisza, and the northern part of the sandy land in Pest county; next in the country about Versec and Fehértemplom and the sandy region of Hajdu and Szabolcs counties, which are separated from the central part of the Great Plain by a belt in which the disease appears late. After these two sandy regions comes the Kis-Alföld.

VII. — Mildew appears relatively late on the alluvial soils of the left bank of the Tisza, and along the Bodrog and the Maros and especially in the parts watered by the three branches of the Körös and the Bega, as well as on both banks of the Tisza (in Szolnok and Heves counties) Szolnok as far as Tokaj; the same is the case in Torontál and Temes counties, in the valleys of the Temes and of the Bega, and in the southern parts of Bács county; the orographic and climatic conditions of these districts differ very little from those of the districts in which mildew appears early. This delay is rather due to the lack of great extents of alluvial soil and the presence of large areas on which water stands.

VIII. — The disease appears latest, about 60 or 80 days after its first appearance in Hungary, in the western, southern, north-eastern and south-eastern parts of vine-growing Hungary situated at heights above 1,000 ft. (660 ft.) and lastly in the eastern parts (Transylvania).

IX. — It appears from the study of the climatic data that the temperature of the month of April has a determining influence on the appearance of mildew. Provided there is enough moisture in winter and spring, which is almost always the case, mildew appears the earlier the more regular the temperature in April. If in the month of April or at least in its second half night frosts have ceased (even though the warmth during the day may not be considerable), the appearance of mildew may be expected at the middle of May. But if there are repeated relapses in the rise of temperature in April the appearance of mildew will be retarded. This delay in the date of appearance will be all the greater the more frequent the relapses have been.

and the longer they have lasted. In this case the appearance of *m* may be retarded to the end of May.

X. — The account of the weather before the first appearance of mildew has been kept as follows. A determination was made for each locality and then for the whole of the country situated within the isophanes of the amount and frequency of the rainfall and the mean temperatures from April 1. By multiplying these three data by the number of days after April 1, a figure has been obtained in which the climatic factors appear in proportion to their biological value.

These biological values of the weather seem to show that in general mildew makes its appearance in a district when the biological value of the weather reaches the figure that it had in the first isophane of the country. The great deviations that the biological values of the different years present may be eliminated by introducing into the calculations a factor connected with the value of the position of the rain. (1) The biological value obtained for 1910 to 1913 is 281 ± 14 .

The writers call this figure "Bios". It expresses the value of the weather calculated according to the above formula, when the meteorological conditions for the first appearance of mildew have been reached. Expressed in a mathematical formula: — $B = c. g. h. k. T$, in which Bios, c = the mean rainfall from the first of April to the day of the appearance of mildew, g = the average of its frequency, h = the mean daily temperatures, k = the influence of the date at which the rain falls, T = the number of days of the period.

The regular decrease noticed in the table of the "Bios" values may serve as a kind of forecast. It is assumed that after the first isophane there will be no greater irregularities in the weather than in the period between the 1st of April and the first isophane. The deductions are made according to the rule of three, using the "Bios" of the first isophane as the "Bios" of the isophane in question. A series of numbers in inverse ratio to the series of decreasing "Bios" values is thus obtained.

Carrying out this calculation for the years 1910 to 1913 the following numbers of days are obtained:

Isophane	II	III	IV	V	VI	VII
1910	51	55	63	69	83	90
	51	56	63	74	91	117
1911	47	57	65	73	80	97
	47	52	59	70	87	113
1912	56	60	63	65	71	86
	61	66	73	84	101	127
1913	55	66	65	73	80	81
	53	58	65	76	93	119

The figures in heavy type show the date on which mildew was calculated to appear, those in ordinary type the actual date of appearance.

(1) This refers to the fact that rains of equal amount are more effective when they fall nearer to the date of appearance.

be seen that the two sets of figures show very considerable agree-

he prognostic value of these series is undoubted, but their application is limited by the delay of three days necessary in calculating from the isophane.

ut the formula $B = c. g. h. k. T.$ renders one independent of the isophane; it has only to be borne in mind, according to the process used in the original work and for a great number of localities situated regularly as possible, when the "Bios" attain towards the middle of the value of $281 + 14$. It is in such localities that the appearance of the disease may be expected shortly; in this forecast use may advantageously be made of the temperature curve of the month of April and of the knowledge of ecological factors. One of the chief conditions of success of this method is a network of meteorological stations in perfect working order in telegraphic connection.

XI. — According to these researches the districts in which mildew first appears in Hungary are determined by orographic and climatic conditions and especially by the nature of the soil and the conditions of superficial hydrography. The weather only influences the date of appearance. The disease does not appear first in the warmest districts where most rain falls, but in the southern part of the Great Hungarian Plain where there are extensive sandy areas and a number of tracts liable to drought. On the other hand the disease appears late, even in the southern districts, on cold soils, notwithstanding the abundance of superficial water and favourable weather. After an April with regular temperature without white frosts the first appearance of mildew may be expected in the middle of May, and in general when the value of the "Bios" calculated from the 1st of April reaches the figure of 281.

Results of Investigations made in Austria in 1913 into the Leaf-curl of potatoes (1). — KÖCK, G., KORNAUTH, K., and BRÜZ, O., in *Zeitschrift für das deutsch-wirtschaftliche Versuchswesen in Oesterreich*, Year XVII, Part 5, pp. 270-300. Vienna, 1914.

During 1913 the writers continued in several parts of Austria the work which had been commenced on a large scale several years before. Among other investigations they carried out a whole series of insect experiments with different species of *Fusarium* on several varieties of potatoes by simply surrounding the root crown of the plants with infected soil.

The most important conclusions that have been drawn from these and from the preceding investigations are the following:

- 1). Leaf-curl is a fungoid disease caused by forms of *Fusarium* or *Sclerotinia*; the former are predominant towards the south (for instance Austria-Hungary), the others towards the north (northern Germany).
- 2). The primary infection (that is that of a plant that till then had

(1) See also No. 580, *B.* June 1914; No. 683, *B.* July 1914.

been healthy and had sprung from a healthy plant) is caused by containing the above disease-producing agents.

3). The tubers obtained from a plant attacked by leaf-curl are all necessarily diseased; some shoots may be quite immune and will naturally produce sound tubers; tubers formed on the shoots infected by fungus are in some cases more or less infected by the mycelium of the parasite, or when the mycelium remains restricted to the vascular bundle of the haulm and the stolon, such tubers appear singularly weakened by the injurious action of the mycelium on the movements of the sap.

4). When tubers infected by the mycelium are planted, one of two following circumstances is observed: either the mycelium grows (this is rather rare) in the young shoots in course of formation — and the result is what the writers call "secondary infection", with a new appearance of curled leaves, — or (as is the case with tubers not containing mycelium but weakened) sickly and weak plants are produced but without leaf-curl; the writers give this the name of "Folgekrankheit" (after-effect of the disease).

5). Leaf-curl and its after-effects may be spread by tubers produced by shoots which had suffered from primary infection (deriving from the soil).

6). Different varieties of potatoes possess a very different resistance to the disease; it seems as if none were completely immune.

7). For the control of the disease the following measures are commended: a) to abstain from growing potatoes for at least five years in those fields in which leaf-curl has appeared; b) to select seed potatoes with the greatest care, to grow only varieties which have proved suitable to the locality and to choose a favourable soil; c) to strengthen the plants by appropriate manuring; d) to pick out carefully and remove from growing crop any infected plants.

859 — A Disease Affecting the Sisal Hemp Plant: *Colletotrichum Agaves* Cav. (1). — BANCROFT, C. K., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 4, pp. 181-182. Demerara, April 1914.

The leaves of sisal hemp (*Agave rigida* var. *Sisalana*) grown in British Guiana have during the past five years been affected by a disease which renders them useless for the preparation of the fibre, and which is due, according to laboratory observations, to *Colletotrichum Agaves* Cav.

As far as is at present known the parasite has appeared only on plants grown away from the coast, but the plant has not been cultivated near the coast to any great extent.

The fungus has been grown on artificial media. Inoculations on cut surfaces of leaves (incisions, wounds, etc.) have confirmed the observations of Shaw on the reproduction of the disease and on the pathogenic agent. Attempts to reproduce the disease by placing the fungus on injured surfaces of the leaves have failed, thus again confirming the

(1) See No. 883, B. July 1913.

in that the organism is a wound parasite, *i.e.* can only affect the leaf locally at a broken surface.

The "New Disease" or "Dry Disease" of the Sugarcane: *Marasmius sacchari*. — BANCROFT, C. K., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 4, pp. 183-187. Demerara, April 1914.

The writer describes under the name of "new disease" or "dry disease" the disease caused on the sugarcane by the fungus already known by the name of *Marasmius Sacchari*. The disease was first observed in British Guiana at Berbice in 1907; it has subsequently been reported to occur on many estates in different parts of the Colony. On some of these it extended greatly, while on others it does not appear to have progressed rapidly and in some few cases it has disappeared after a short time. The writer reports upon the methods employed in combating the disease. The varieties which are generally badly affected in this Colony are Bonaparte, D 625, B 208 and Green Transparent. The two former suffer more than any other varieties. D 109 is also frequently affected; D 145 and D 118 are more resistant, while D 216 and D 159 are not reported to be affected.

The planting of the more resistant varieties in badly affected fields for a period of several years for the purpose of checking the spread of the disease is a matter which should receive careful consideration, as well as the sowing of infected stools with plants of more resistant varieties. The effect of these methods would be to reduce the fungus in the soil to a minimum before replanting with the more susceptible varieties.

Two New Species of Fungi in Tobacco Seeds Beds: *Gloeopeziza turricula* and *Hyalopus geophilus*. — SACCARDO, P. A., and PEYRONEL, B., in *Bollettino tecnico della coltivazione dei tabacchi, pubblicato per cura del R. Istituto sperimentale in Scafati (Salerno)*, Year XIII, No. 1, pp. 3-6, 1 plate. Scafati, 1911.

The writers received from the Royal Experiment Institute for the cultivation of Tobacco at Scafati two samples of mould from tobacco seedbeds, attacked by two species of fungi which they consider new to science which they describe under the names of *Gloeopeziza turricula* and *Hyalopus geophilus*.

The former is a discomycete characterized chiefly by its ascophores, which are cylindrical or shaped like elongated truncated cones resembling towers (whence the specific name); it is visible as brick-red dots in the mould, and, according to the information collected by the writers, appears generally in January and February on the seedbeds formed of tobacco which have previously been warmed and are protected by cover.

It develops in patches, frequently large, and forms a kind of crust that hinders the development of the germinating tobacco seeds and kills them. The species is allied to *G. Rehmii* Zuk. and *G. Zukalii* n., from which it is easily distinguished by certain morphological characters. In another sample of mould received later the writers recognized *G. turricula* in a very young stage of development; this material is the result of preliminary observations on the sexual organs (carpogonia)

and antheridia) contained in the young ascophores, which are then completely red.

Hyalopus geophilus (Mucedineae) is very minute and completely hyaline, so that it is difficult to distinguish it without the help of the microscope; this fungus develops on the same places as *G. turricula*, over which it spreads.

These two species do not live on moulds that have been carefully heated to about 100° C. (212° F.) for a couple of hours. Such partial sterilization is therefore recommended for the prevention of these fungi as well as of parasitic diseases, weeds, etc.

862 - *Cladochytrium Mauryi* and *C. Ollivieri*, New Phycomyces on the leaves of *Colchicum autumnale* and of *Orchis incarnata* and *O. laxiflora* in France. — HARIOT, P., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1914, 1st H. H-year, Vol. 158, No. 23, pp. 1705-1707, Paris, 1914.

The writer describes (with Latin diagnosis) two new species of *Cladochytrium*. One, *C. Mauryi*, was found in May 1914 on leaves of *Colchicum autumnale* at Châlons-sur-Marne; it seems to differ from all other species that have been described as parasites of Liliaceae and Iridaceae. The other, *C. Ollivieri*, was found in May and June of the same year on leaves of *Orchis incarnata* and *O. laxiflora* at Esbly (Seine-et-Marne).

C. Ollivieri is very near *C. Mauryi*, but can be distinguished by its spots it forms being darker, longer and smoother; its spores also are larger.

Orchis laxiflora appears to be only exceptionally attacked, and its spots upon it seem smaller and more scattered and never run together to occupy the whole area of the leaf. At Esbly plants of *Colchicum* grow in abundance among the orchises are never attacked; at Châlons-sur-Marne on the contrary the orchises are never attacked.

The leaves of *Orchis* on which *C. Ollivieri* is growing are frequently infected by the aecidium stage of *Puccinia Orchidearum-Phalaridis* Kleb.

Perhaps the two species of *Cladochytrium* are only biological species; they resemble in this the rusts of the group of *Puccinia graminis* and *P. Rubra*, and the species of *Peridermium*.

INSECT PESTS.

863 - Occurrence of the Colorado Beetle (*Leptinotarsa decemlineata*) in many (1). — *Illustrierte landwirtschaftliche Zeitung*, Year 34, No. 57, pp. 575-576, 1 fig. Berlin, 1914.

The presence of the Colorado potato beetle (*Leptinotarsa decemlineata*) which had not been seen in Germany since 1887, has been reported from Hohenwedel near Stade (Hanover); the Government immediately ordered the most drastic measures against this dangerous beetle.

(1) See also Nos. 2295 and 2360, B. July 1911.

Micrococcus nigrofaciens as Cause of an Infectious Disease of the Larvae of *Lachnosterna* spp. in the United States and in Portorico. — NORTHERN ZAB. in *Centralblatt für Bakteriologie, Parasitenkunde u. Infektionskrankheiten*, Part II, Vol. 41, No. 11-17, pp. 321-339, figs. 1-5, plates I-IV. Jena, 1914.

During the summer of 1912 specially severe injury to various crops to the white grubs of May or June beetles (*Lachnosterna* spp., *Scarabaeidae*) were reported from Michigan.

The appearance of these beetle larvae was accompanied by the manifestation of a bacterial disease characterized by the blackening of the parts of their bodies affected. The cause of the infection is a species of *Micrococcus*, for the above reason named *M. nigrofaciens*. It was found under microscope in almost pure culture on agar plates inoculated from the diseased part of a live larva. It is frequently associated with a gas-producing bacillus (*Bacillus septicus inscetorum* of Krassiltschik ?), from which it is separated with difficulty.

The *Micrococcus* lives in the soil and is present in many soils of Michigan, Illinois, Maryland, Northern Carolina, Portorico and very probably other countries also. It grows well on the usual nutritive media, but is better on the special media prepared with the larvae (gelatine, agar, etc.) and on the larvae themselves. It colours well with the usual water and alcohol colours, and shows clearly the process of division; it is Gram-negative but not acid-fast.

The disease has been successfully reproduced in a healthy larva of *Lachnosterna* by placing it on artificially infected soil and incising its integument.

The characteristic alteration was also caused in some healthy larvae of another beetle, *Allorhina nitida*, by placing them on soil soaked with water and sterilized, to which some broth containing the *Micrococcus* in suspension was added. It seems as if in the individual larvae of the same species the power of resistance to the *Micrococcus* varies greatly. The largest seem to be the most susceptible; the larvae of *Lachnosterna* are less resistant than those of *Allorhina*.

The micro-organism in question proved pathogenic to adults of *Peridroma americana*; the disease followed its course as in the larvae of *Lachnosterna*; nevertheless the infection was apparently limited to the legs. It has not been possible to determine whether the *Micrococcus* is pathogenic for earthworms, nor have repeated attempts to isolate it from naturally infected soil succeeded.

Excessively moist soil favours the progress of the disease and this may be considered one of the chief factors in rendering the infection mortal.

In the soil there exist other organisms which may produce an infection in the larvae. The above-mentioned gas-producing bacillus found in the culture plates appears in determined conditions to contribute to render the disease mortal and it may be the first micro-organism to invade the insect.

The *Micrococcus* does not lose its virulence after having been cultivated artificially for upwards of a year.

It has not yet been possible to try this micro-organism as a means in the control of the larvae of *Lachnosterna*; this will, however, be as soon as possible. The larvae of some *Lachnosterna*, commonly called "caculo" or "gusano blanco" at Portorico, are there very injurious to sugarcane: in order to experiment the *Micrococcus* against them, cultures have been sent to Rio Piedras and Mayaguez; no definite results have been obtained.

From the conclusive results obtained by inoculating and saturating the soil, the inference may be drawn that the *Micrococcus* may in future be usefully employed in the control of the larvae of *Lachnosterna*, especially in conjunction with other parasitic diseases to which the larvae are subject. Since this micro-organism has also the power of infecting the larvae of another genus (*Allorhina nitida*) and also of insects (*Periplaneta americana*), it seems to suggest the possibility of extending its use, applying it especially in the control of other injurious larvae in the soil.

865 - The Grass Moth (*Remigia repanda*), a Pest of Sugarcane, Rice and Paragrass in British Guiana (1). — BODKIN, G. E., in *The Journal of the Board of Agriculture of British Guiana*, Vol. VII, No. 4, pp. 171-177. Dec. April 1914.

Remigia repanda is a member of the family Noctuidae; owing to its habit of living on numerous grasses, and particularly paragrass (*Panicum muticum*) it has been given the popular name of Grass Moth. In British Guiana it has been a well-known pest for many years, though this is the first account of its life-history published in the Colony.

On sugarcane, rice — with the rice caterpillar (*Laphygma frugiperda*) — paragrass and other grasses throughout the coastlands this moth may be found all the year round, and at certain periods, particularly the occurrence of rain after prolonged drought, the larvae appear in great hordes completely destroying whole areas of the above crops. It also occurs in several of the interior districts.

In Trinidad it has recently occurred as a serious pest and it is also known as a pest in Jamaica. The following are the localities where *R. repanda* has been recorded: Canada, Labrador, United States (Texas, Florida), Mexico, Honduras, Costa Rica, Panama, Colombia, Venezuela, Guiana, Brazil, Argentina, Antilles (Cuba, where it has been recorded on *Hypericum*, San Domingo, Jamaica and Martinique).

Under normal conditions this insect is not responsible for any serious damage and may easily be controlled.

The various instars of the life-history of this insect in the Colony coincide with those which have been described by Dr. Dyar of the United States; his description is appended by the writer. The ova have never been observed on the food-plants in this colony. The complete life-cycle occupies under normal circumstances from 26 to 31 days.

No actual parasites have so far been secured from this insect in British

(1) See also No. 803, B. Aug. 1914.

Luiana. The Coccinellid beetle *Megilla maculata* De Geer frequently on the young larvae, and the so-called Demerara Robin (*Leistes* *ensis*) will also feed on them.

On sugar estates the usual method employed when a slight attack of pest occurs is to pick them off the canes by hand and drop them into buckets containing kerosene and water. When efficiently carried out is an effective measure, but the application of dry powdered arsenate would give just as satisfactory results and would prove cheaper. When it attacks rice in the nursery beds, flooding may be resorted to described for the control of the rice caterpillar.

As regards paragrass, the value of the crop hardly guarantees the adoption of control measures; a field when badly attacked may be left to the caterpillars enter the chrysalis stage and then burnt off to prevent further infestation.

A New Sugarcane Aphis (*Aphis bituberculata*) in Louisiana. — WILSON, H. F., in *Entomological News*. Vol. XXV, No. 7, pp. 298-299, plate XIII. Philadelphia, 1914.

The writer received in 1912 some specimens of an aphid which had been found on *Saccharum officinarum* in Louisiana (Audubon Park, New Orleans). Not having been able to identify it with any other aphid found on sugarcane, he describes it as new to science under the name of *Aphis bituberculata*.

Edworms Injuring Hops in Bavaria. — WAGNER in *Praktische Blätter für Pflanzenschutz*, Year XII, Part 6, pp. 66-68, 1 fig. Stuttgart, 1914.

In August 1913 the writer observed at Pörsbach in a well cultivated 15-year-old hop garden a few dozen plants near each other which presented a very stunted growth. The hops were quite withered and worthless. It has been ascertained that the mischief was due to the presence of edworms—very probably *Tylenchus devastatrix* Kühn—on the rootlets. Edworms had not previously been observed at Pörsbach, even on other

***Godara comalis*, a Cabbage Moth, Attacking Turnips in Queensland.**

JARVIS, E., in *The Queensland Agricultural Journal*, New Series, Vol. I, Part 6, pp. 427-429, plate 62. Brisbane, 1914.

One of the least known cabbage moths, *Godara comalis*, has recently infested a decided liking for turnips, the caterpillars feeding freely on the leaves so as to leave only the skeleton.

This species is sometimes found in association with *Hellula undalis*, another pest known as the cabbage webworm, which not only causes damage to this vegetable, but is destructive at times to turnips and other cultivated Crucifers.

With reference to control, prompt measures at the commencement of the season are of the utmost importance, since destruction of the first brood of moths will materially decrease the injurious action of succeeding generations. Arsenical sprays are of little use against larvae well established

among the heart leaves of big cabbages, but should be effective applied to young plants or to the foliage of turnips.

The writer does not believe that this pest has hitherto been resorted to as attacking cabbage seed-beds, but if it should do so Bordeaux mixture sprayed upon seedlings whilst in the bed and when planted out should act as a deterrent.

It is advisable to destroy carefully all weeds, especially of Cruciferous plants, and any badly injured cabbages, and never to allow stumps or worthless leaves to remain in the field after the crop has been removed. Such refuse should be put in a heap and burnt without delay. Cultivate between cabbages at a time when the larvae are in the pupal stage and doubtless destroy many of them, and also improve the general condition of both crop and soil.

869 - The Rose Beetle (*Adoretus vestitus*) and the Injury it Causes in Samoa Islands. — FRIEDERICH, E., in *Zeitschrift für wissenschaftliche Insektenkunde*, Vol. X, Part 2, pp. 41-47, figs. 1-6. Berlin-Schöneberg, 1914.

The writer gives a minute description of the larva, pupa and imago of *Adoretus vestitus* Boh., which is very abundant in the island of Upolu where it is called "Rosenkäfer" by the German colonists, as the pest attacks by preference rose leaves, which it riddles completely. Rose plants are often quite despoiled of their leaves and killed. The insect feeds also on larger leaves such as those of cacao, and in a characteristic manner, leaving only the outer edges and the ribs untouched. The writer recently observed many young cacao plants in a plantation destroyed by *Adoretus*. Even large trees were seriously injured by the insects. Other frequent host plants are *Coffea liberica*, *Hibiscus tiliaceus* ("fau" of the Samoans; almost every plant has its leaves completely devoured), *Terminalia litoralis* ("talie" of the natives) and others.

The injury caused by these beetles, with the exception of that to roses (which have no economic importance in Samoa), has not hitherto been very severe; the insect and the mischief that it does are, however, on the increase and perhaps before long it may become dangerous.

The eggs of *Adoretus* are unknown to the writer. The larvae are fully developed are about eight-tenths of an inch in length; they are yellowish white and are found at all times and of all sizes on the roots of Gramineae and under rotting vegetable matter, especially in decomposed farmyard manure, from which it may be inferred that the insect multiplies all the year round. Before pupating, the larvae rest for a long time then they prepare, by means of a special secretion, a kind of cocoon of earth which protects them from their enemies. The larvae do not injure the roots of plants. Probably the insect has been introduced into Samoa Islands (where it was first noticed about six years ago) in the larval stage by means of vegetable matter surrounded by earth. The adult insect is from 0.4 to 0.5 in. long; its colour varies from yellow to a brownish red. It lies hidden during the day and is therefore rarely found; it feeds and mates at night. If disturbed it allows itself to fall from the leaves. It appears in great numbers throughout the year.

It has been observed that it is always the small cacao trees not sheltered in any way which are killed by the insect, while those in the shade of other or surrounded by bananas, for instance, often remain uninjured. They have been protected by mosquito curtains being thrown over them and cacao nurseries might be equally protected by old fishing nets. Shaking the plants and collecting the adult insects has given only partial results, as new individuals keep on appearing. Spraying with various substances has prevented the beetle from devouring the leaves, but these have been damaged by the remedies used. Insectivorous birds and mammals ought to be introduced into Samoa to feed upon the larvae in the soil. Hitherto the attempts to infect *Adorctus* with the green muscardine fungus (*Metarrhizium Anisopliae*), which has been recently used in Samoa with very promising results against the larvae of *Oryctes rhinoceros*, the worst enemy of cacao, have failed. The writer will continue his searches in this direction.

